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BULLETIN No. 14.

Agros. 34.

U. S. DEPARTMENT OF AGRICULTURE.

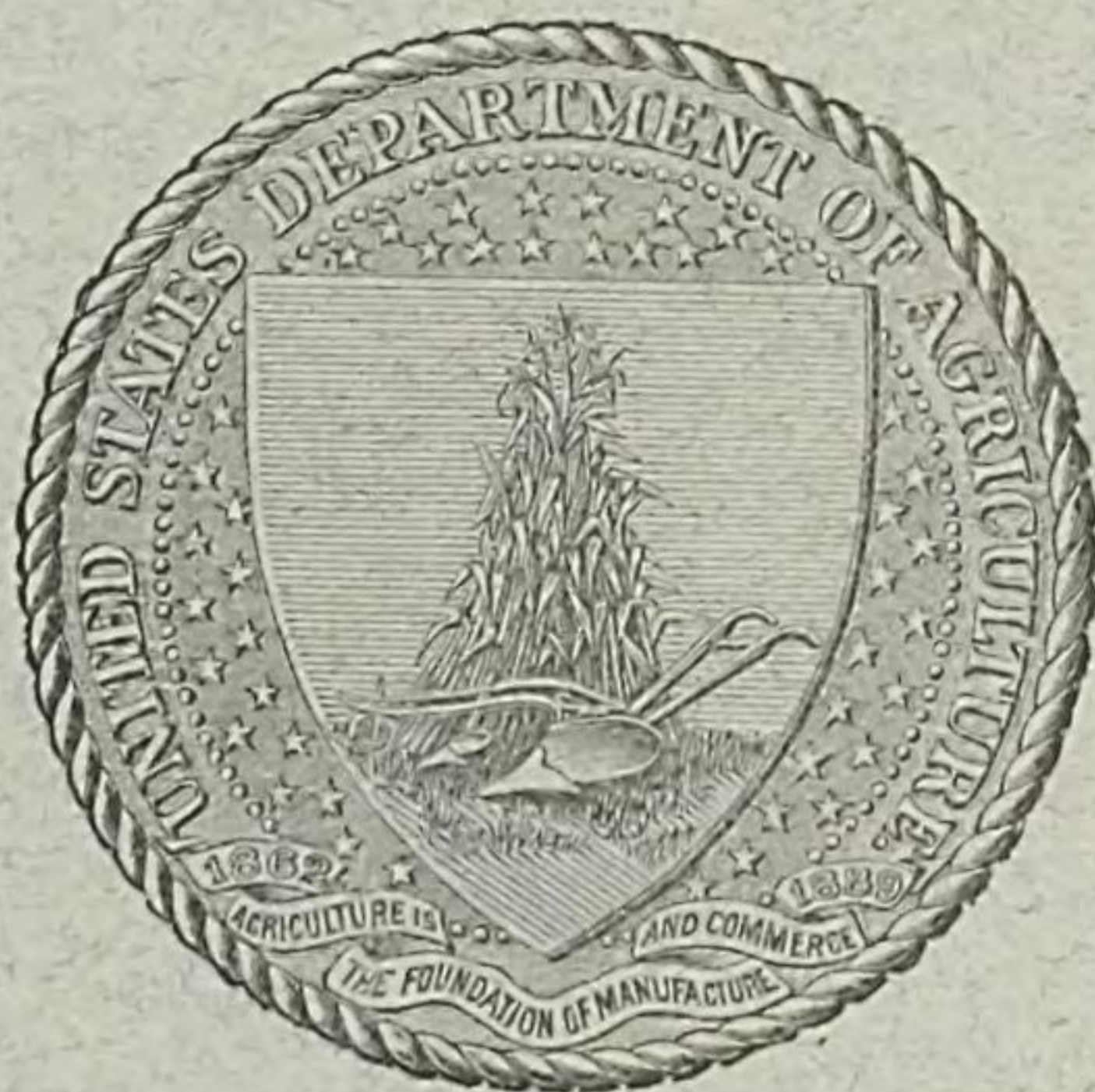
DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

ECONOMIC GRASSES.

BY

F. LAMSON-SCRIBNER,
AGROSTOLOGIST.



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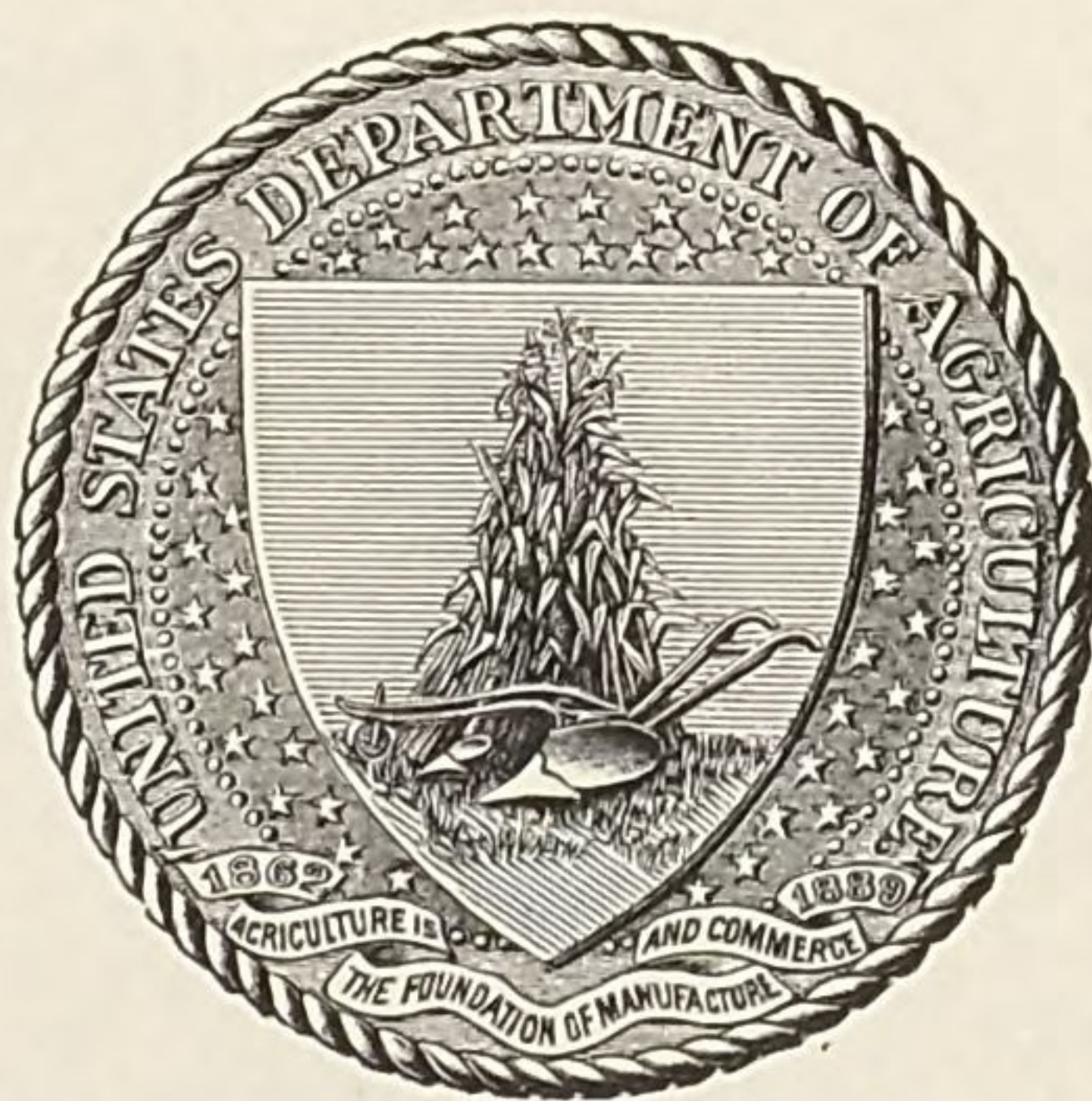
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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF AGROSTOLOGY,
Washington, D. C., June 29, 1898.

SIR: I have the honor to present and recommend for publication as Bulletin No. 14 of this Division manuscript containing brief descriptions of the more important economic grasses of this country or those which have been introduced because possessing some merit. This publication it is believed will afford a ready answer to the usual inquiries respecting a large number of our grasses. Much of the matter here presented is taken from Bulletin No. 3 of this Division, but owing to the fact that that bulletin exceeded 100 pages the edition published was limited to 1,000 copies, and consequently was very quickly exhausted. The matter has here been condensed in order that a larger edition may be published to meet the demands of correspondents.

Respectfully,

F. LAMSON-SCRIBNER,
Agrostologist.

Hon. JAMES WILSON,
Secretary of Agriculture.

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ECONOMIC GRASSES.

DESCRIPTIONS.

No. 1. *Agropyron caninum* (L.) R. & S. Bearded Wheat-grass.

A fibrous-rooted, rather slender, upright perennial, 2 to 3 feet high, with bearded, nodding heads or spikes resembling slender heads of wheat. This grass is more or less frequent in the northern parts of the United States, ranging from Maine westward to the Dakotas. Bearded Wheat-grass is closely related to the more common and better known Couch-grass (*A. repens*), but differs markedly from that species in having no creeping rootstocks, and in the longer beards or awns to the spikelets. No attempts have been made to introduce this grass into general cultivation, but its habit of growth and other characters indicate that it may possess considerable agricultural value. It is readily propagated by seeds, which may be easily gathered.

No. 2. *Agropyron divergens* Nees. Wire Bunch-grass.

A slender, usually densely tufted perennial, 1 to 2 feet high or more, with very narrow, spreading leaves, and bearded or beardless spikes. The beards or awns, when present, are widely spreading or divergent. This grass is common in the Rocky Mountain and Pacific Slope regions, extending westward to the coast. On rich lands it often grows to the height of 3 feet, but upon the dry bench lands it rarely exceeds a foot or 18 inches in height. On dry lands the stems become wiry with age, and are avoided by stock; but the grass is considered valuable by the ranchmen for winter grazing. Samples of this grass received from some points in the West, particularly from Washington, indicate that it possesses much agricultural value when grown upon good soil, and as it will thrive in the semiarid regions of the Northwest, its cultivation may prove desirable. Propagated readily by seed, which can be easily gathered.

No. 3. *Agropyron pseudorepens* Scribn. & Smith. Western Couch-grass.

A perennial, with creeping rootstocks, abundant in the northern prairie States, producing tall and leafy stems, which resemble those of Couch-grass, but are less wiry. This is less plentiful in the semiarid belt than the Western Wheat-grass or Colorado Blue-stem, but is better adapted for cultivation as a hay grass because of its softer stems and leaves. It is one of the most promising native species.

No. 4. *Agropyron repens* (L.) Beauv. Couch-grass. (Fig. 1.)

A grass abundant everywhere in the Eastern and Middle States, growing in the open fields, and in many places it has become one of the worst of weeds. Often the chief labor in managing hoed crops consists in subduing this pest. When once established, it is hardly less difficult to eradicate than the well-known Johnson-grass of the Southern States. It is, however, a valuable hay grass, and for two or three years the yield is large, but, like the Western Blue-stem, it "binds itself out," and the sod requires breaking in order to restore the yield. It is an

excellent grass for binding railroad and other embankments subject to wash, and can be recommended for this purpose. The roots are well known in medicine under the name of *Radix graminis*. The simple infusion is used as a diuretic. Propagated by "root cuttings" or by seed.



FIG. 1—Couch-grass (*Agropyron repens*).

No. 5. *Agropyron spicatum* (Pursh) Scribn. & Smith.
Western Wheat-grass.

A grass closely resembling the Couch-grass of the Eastern States, and by some regarded as only a variety of it. It has the same strong and extensively creeping rootstocks, and the foliage and spikes are very similar, but the whole plant usually has a bluish color, whence the common name "Blue-stem," most frequently applied to it in the West. It grows naturally on the dry bench lands and river bottoms; and, although the yield per acre is not large, the quality of the hay is unsurpassed by any other species of the region where it grows. In Montana and the neighboring States it furnishes a considerable amount of native hay, and is there regarded as one of the most important of the native forage plants. After three or four successive annual cuttings, the yield diminishes very much, but the grass is "brought up" by letting it stand a year or two, or by dragging over the sod a sharp-toothed harrow, thus breaking the roots into small pieces, every fragment of which makes a new plant. This grass is quite distinct from the "Blue-stem" grasses of Nebraska, which are

species of *Andropogon* (*A. provincialis*). There are a number of other species of *Agropyron* or wheat-grasses in the Rocky Mountains, some of which are evidently excellent hay grasses and well deserve the attention of the agriculturist.

No. 6. *Agropyron tenerum* Vasey. Slender Wheat-grass.

A perennial bunch grass growing in the northern prairie region from Nebraska to Montana and Manitoba. Seed of this grass is now on the market, its sterling qualities for hay having long been recognized by Northwestern farmers. It produces an abundance of soft, leafy stems and root leaves, and ripens a large amount of seed that is easily gathered—two of the chief requisites of a good hay grass. This grass is well adapted for cultivation, and the area devoted to it is deservedly increasing each year.



FIG. 2.—Redtop (*Agrostis alba*).

No. 7. *Agrostis alba* Linn. Redtop or Herd's-grass.

Under the botanical name of *Agrostis alba* are included a number of varieties, some of which have received distinct Latin names; as, for example, *Agrostis vulgaris*

and *Agrostis stolonifera*, and many English or local names; that most generally applied in the Middle and Eastern States being Herd's-grass, and in the South and West, Redtop. The great variability of this grass has led to much diversity of opinion in regard to its value. The taller forms are largely cultivated for hay, being usually mixed with timothy and clover. This grass requires considerable moisture in the soil, and is one of the best for permanent pastures in the New England and Middle States. It makes a very resistant and leafy turf, which well withstands the trampling of stock. It grows well, also, as far south as Tennessee. Among the forms of low growth are two varieties which are unsurpassed, either in fineness or richness of color, for making lawns.

No. 8. *Agrostis asperifolia* Trin. Rough-leaved Bent.

This grass is common in the Rocky Mountain regions and on the Pacific Slope, growing chiefly in the mountain parks and along water courses. Its slender leafy culms are 2 to 3 feet high, and the narrow, pale-green, and densely flowered panicles 4 to 6 inches long. Judging from the appearance of this grass, it is likely to prove, under cultivation, superior to the Herd's-grass or Redtop of the East, at least for hay.

No. 9. *Agrostis canina* Linn. Rhode Island Bent.

This species of bent has been introduced into this country from Europe, and is cultivated to some extent in the Eastern States. It resembles Herd's-grass (Redtop) somewhat, but has shorter and narrower leaves. It makes a close sod, and is considered valuable for permanent meadows and pastures. It is one of the best grasses for lawns, and for this purpose should be sown at the rate of 3 to 4 bushels per acre. Retail price of seed quoted in New York catalogues, \$2.75 per bushel.

No. 10. *Agrostis coarctata* (Reichb.) Ehrh. Sea-coast Bent.

A creeping perennial with slender culms, the upright branches 1 foot high, short and narrow flat leaves, and densely flowered panicles 2 to 4 inches long. It grows in damp soils and sands along the sea coast from Newfoundland to New Jersey, often occurring where constantly drenched by the flying salt spray. It is a fine-leaved, excellent turf-forming species, valuable for lawns. A similar if not identical species is common in western Oregon and Washington.

No. 11. *Agrostis exarata* Trin. Northern Redtop.

The grass upon which this species was founded is a native of Alaska, but a number of forms which occur in the Rocky Mountain regions and on the Pacific Slope have been referred to it. Some of these have been characterized as distinct species, and there are several among them which, from their tall, leafy habit and vigorous growth, indicate the possession of considerable agricultural value, although none of them have as yet been introduced into cultivation. They are deserving of the attention of the agriculturist, and their culture is recommended, particularly on the Pacific Slope. They would doubtless thrive in the Eastern and Middle States, and possibly supplant, by their greater luxuriance and better qualities, some of the species now cultivated.

No. 12. *Agrostis scabra* Willd. Rough Bent.

A slender, erect, tufted annual, with numerous very narrow basal leaves, and delicate, widely spreading capillary panicles, which at maturity break away from the culm, and are blown about by the wind, hence one of the common names, "fly-away-grass." Before the panicle has fully expanded, this grass is sometimes gathered and sold under the name of "silk-grass" for dry bouquets. It is widely distributed throughout the United States, but is of little or no agricultural value. In irrigated meadows of the Northwest this species, or a form of it, is occasionally sufficiently abundant to furnish a large amount of hay which is regarded of good quality.

No. 13. *Agrostis stolonifera* Linn. Creeping Bent.

By some regarded as only a variety of *Agrostis alba*, with long, prostrate or creeping stems, well adapted for sandy pastures near the coast, and useful, perhaps, for binding shifting sands or river banks subject to wash or overflow. It makes a good pasture grass for low lands, especially for those which are somewhat sandy, and produces a fine and enduring turf for lawns, for which it is especially well adapted. It is not a productive hay grass, although it has a record of yielding on rich, peaty soil 7,742 pounds of hay and 2,722 pounds of green aftermath per acre. If sown alone, sow at the rate of 2 bushels per acre, or for lawns 3 bushels. Current retail price in New York, \$3.50 per bushel.

No. 14. *Agrostis vulgaris* With. Herd's-grass; Redtop.

This is little more than a variety of *Agrostis alba*, already noted. It is quoted in the seed catalogues as a distinct species, and is recommended for mixtures designed for permanent pastures or meadows. It succeeds as far south as Tennessee, and is often sown with timothy and red clover. Retail price of seed, New York market, \$1 to \$1.50 per bushel.



FIG. 3.—Water Foxtail (*Alopecurus geniculatus*).

No. 15. *Alopecurus geniculatus* Linn. Water Foxtail. (Fig. 3.)

A low, usually procumbent grass, with slender stems 8 to 18 inches long, often rooting at the lower joints. It usually grows in wet places, and is very widely distributed throughout the north temperate zone. It has cylindrical heads or panicles, resembling those of Meadow Foxtail, but much smaller. This grass enters into the natural herbage of low, wet meadows and pastures, and in such places affords excellent grazing, being tender and nutritious. *Alopecurus fulvus* is simply a variety of this, with short-awned flowering glumes. Under favorable circumstances this grass makes a good turf and a pleasing lawn of a deep rich green color, remaining green throughout the severe winter weather of the Middle States.

No. 16. *Alopecurus occidentalis* Scribn. Mountain Foxtail.

A grass of the mountain meadows of the Rocky Mountains, growing in rich soil along streams and in the open parks. It has slender, erect stems 2 to 3 feet high, with short, oblong heads, thicker and shorter than those of common Meadow Foxtail. This grass is occasionally found covering extensive areas to the exclusion of other species. It yields a large bulk of fine, long, bright-colored hay, which is highly valued where it can be obtained. For the more elevated meadows of the Rocky Mountain region, and doubtless also for the New England and North Middle States, this grass would form an excellent addition to the cultivated species, and its introduction is recommended.

No. 17. *Alopecurus pratensis* Linn. Meadow Foxtail. (Fig. 4.)

This well-known European grass has been introduced into this country and cultivated to some extent in the New England and Middle States. It is a valuable grass for moist meadows and pastures, particularly the latter, on account of its



FIG. 1.—PLANTING BEACH GRASS IN SAND NEAR PROVINCETOWN, MASS.



FIG. 2.—KAFIR CORN IN GRASS GARDEN OF THE U. S. DEPARTMENT OF AGRICULTURE.

early growth, being one of the earliest of the cultivated grasses. It is very hardy, and on good soil yields a large amount of excellent forage. In Europe it is regarded as one of the best perennial pasture grasses. It should enter into all mixtures for permanent pastures, because it is very lasting, highly nutritious, and earlier than most other species. This grass has a record of producing 20,418 pounds per acre of green grass, 6,125 pounds of hay, and 8,167 pounds of aftermath. It is never sown by itself, but is always mixed with other grasses and forage plants, because it gives a full yield only in the second or third year. Average number of seeds in a pound, 907,000. Price of seed quoted in New York catalogues, \$2.30 per bushel, or \$32 per 100 pounds.

No. 18. *Ammophila arenaria* (Linn.) Link. Beach-grass.
(Fig. 5.)

This grass grows more or less abundantly along the sandy coasts of the Atlantic and the shores of the Great Lakes. It has strong, creeping rootstocks, upright stems 2 to 4 feet high, and long, rather rigid leaves. The narrow, densely flowered panicles which terminate the stems are from 3 to 10 inches long. It is one of the most valuable grasses adapted to binding the drifting sands of our coasts, and has been cultivated for this purpose in this as well as in other countries. The action of this grass in holding the drifting sands is like that of brush or bushes cut and laid upon the ground in accu-

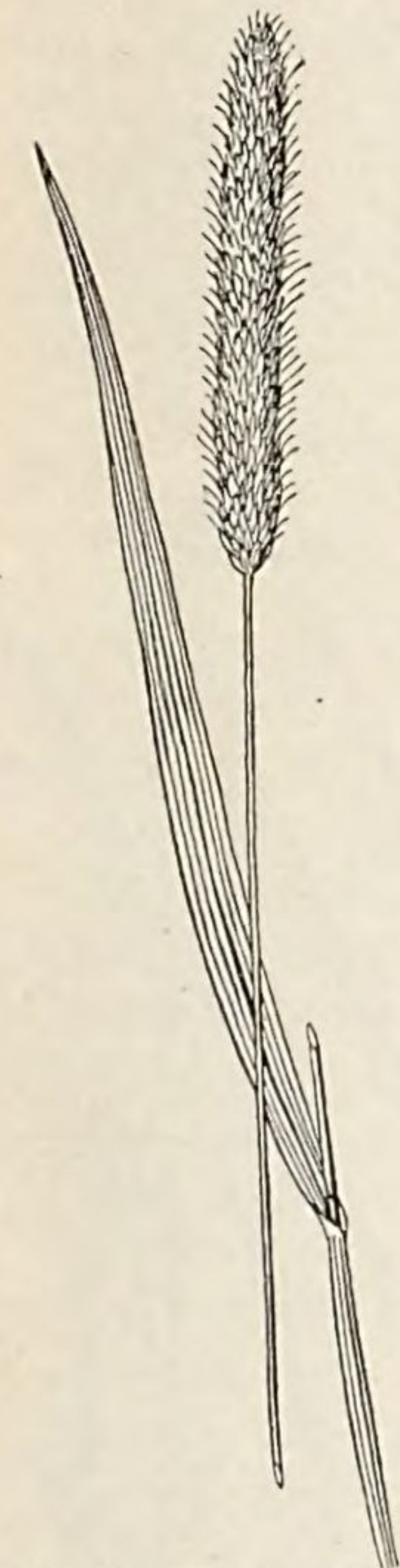


FIG. 4.—Meadow Fox-tail (*Alopecurus pratensis*).

mulating snow when drifted by the wind. The sand collects around the clumps of grass, and as it accumulates, the grass grows up and overtops it, and will so continue to grow, no matter how high the sand hill may rise. This process goes on over the whole surface of the plantation, and thus many acres may be raised far above their original level. A plant will, by gradual growth upwards, finally form stems and roots sanded in to the depth of fully 100 feet. Beach-grass is best propagated by transplanting (Pl. I, fig. 1). The grass is pulled by hand and planted 1 to 2 feet apart, according to the slope, by forcing a long spade or shovel into the sand, which is then carried forward, making an opening into which the roots are thrust, the spade then being withdrawn and the sand pressed close about them. The planting may be done either in the spring or fall, preferably in the fall. When propagation is by seed, the sowing should be done early in the spring and brush laid over the ground for holding the sand and seed temporarily in place. Beach-grass has been used for the manufacture of coarse paper, and it makes an excellent and very durable thatch. It is of no value for fodder.



FIG. 5.—Beach-grass (*Ammophila arenaria*): a, base of culm; b, inflorescence; c, ligule.

No. 19. *Andropogon contortus* Linn. Twisted Beard-grass.

A stout, leafy perennial, 1 to 3 feet high, affording excellent grazing when young, but the mature seeds are much dreaded by sheep owners, as by their peculiar structure they not only become attached to and injure the wool, but often penetrate the skin and even the intestines of these animals. The strong rhizomes and tough fibrous roots which this grass has, commend it as a soil binder for river banks, dams, etc. The awns indicate by their twisting the amount of moisture in the air, and may be used as rain or fair weather indicators. In India this grass is used for thatching. It is a native of tropical and subtropical regions of both hemispheres, extending northward into western Texas, New Mexico, and Arizona.

No. 20. *Andropogon glomeratus* (Walt.) B. S. P. Brook-grass.

A stout perennial, 2 to 4 feet high, with dense, more or less elon-

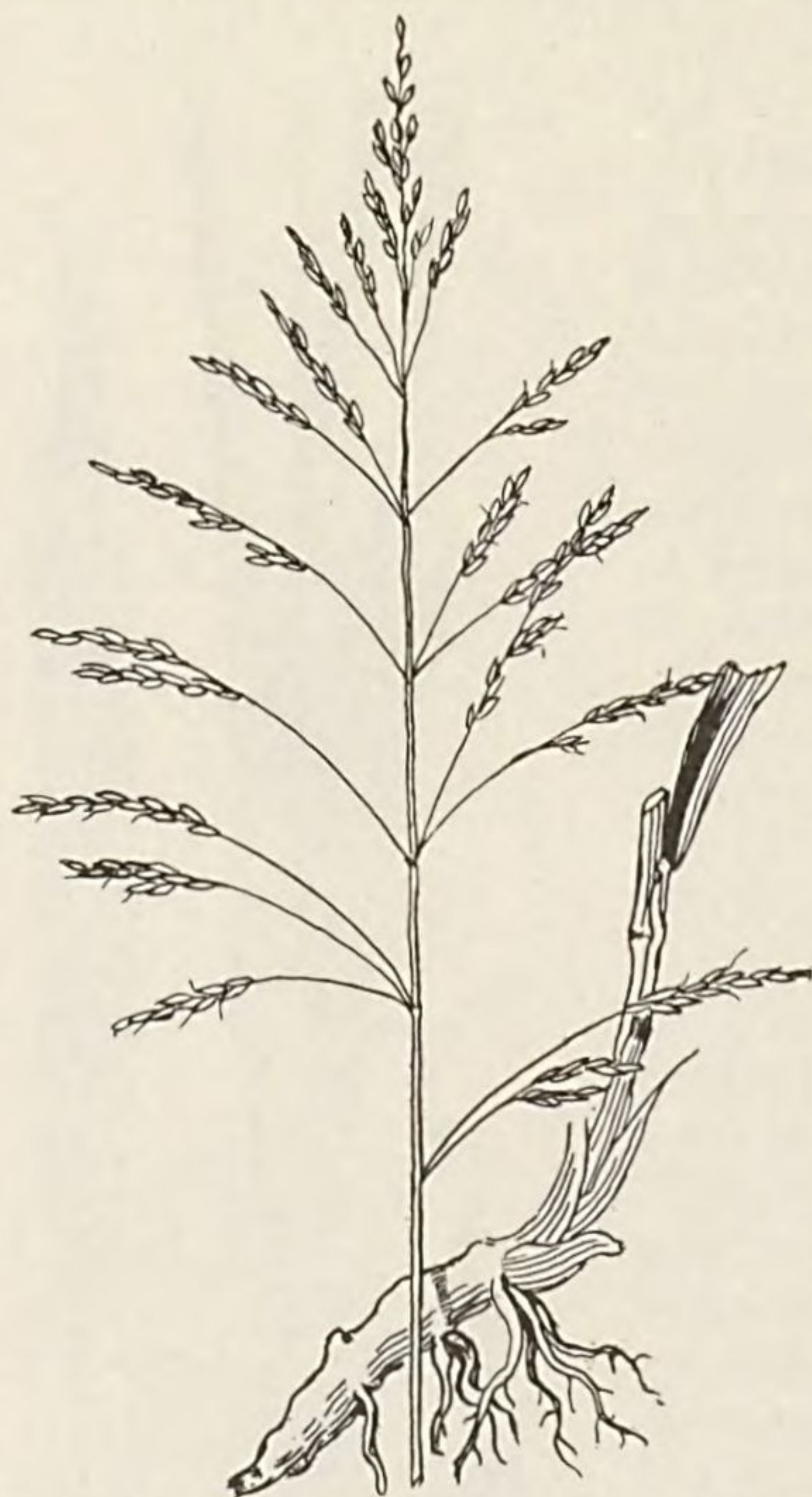


FIG. 6.—Johnson-grass (*Andropogon halepensis*).



FIG. 7.—Bushy Blue-stem (*Andropogon nutans*): *a* to *f*, details of the spikelet.

gated, broom-like panicles. It grows in low grounds and marshes from southern New York to Florida, also occurring in Mexico and Lower California. This species is esteemed a valuable pasture grass in the South. Its stems and leaves when young, are tender and juicy and are relished by stock of all kinds. Later the stems become tough and woody and are of less value.

No. 21. *Andropogon halepensis* (L.) Brot. Johnson-grass. (Fig. 6.)

A stout perennial, with smooth, erect culms, 3 to 6 feet high, and strong, creeping rootstocks. The panicles are expanded during flowering and are from 6 to 12 inches long. It is a native of southern Europe and the warmer parts of Asia and northern Africa. It was introduced into this country about sixty years ago, and has now become widely distributed and well known throughout the Southern

States. In the warmer parts of the Southern States it makes rapid growth, is but little affected by drought, and the hay, if cut just as the grass is coming into bloom, is much liked by all kinds of stock. Two or three cuttings may be made during the season. The extensively creeping rootstocks are fleshy and tender, and hogs are very fond of them. These roots literally fill the ground near the surface, and every joint is capable of developing a new stem. This grass, when once it has become established, is exceedingly difficult to eradicate, and hence has come to be greatly feared by the majority of farmers. Unless one wishes to give up his land entirely to Johnson-grass, and can certainly prevent its spreading to the lands of others, its introduction would be of doubtful economy, owing to its powerful and rapidly spreading roots. In India the natives make rude writing pens from the stems.

No. 22. *Andropogon hallii* Hack.
Turkey-foot.

This is a stout grass, from 3 to 6 feet high, closely related to the Big Blue-stem (*Andropogon provincialis*), but appears to be confined to the sandy regions of the West. It is a good sand binder and is common in the sand hills of Nebraska, and extends southward into Texas. Its agricultural value is not known, but although more woody, it is probably nearly as valuable as Big Blue-stem.

No. 23. *Andropogon nutans* Linn. Bushy Blue-stem. (Fig. 7.)

This is a stout perennial, 4 to 6 feet high, growing in dry soil along the borders of fields and open woods, and on the prairies of the West it often forms a large proportion of the so-called prairie hay. It is held in little esteem in the Eastern and Southern States, but in the West it is said to make excellent hay, and is particularly valuable because of the relatively large amount of long root-leaves which it produces. All stock eat it greedily. In South Dakota it is given the first place among the native grasses as a hay-producing species, thriving best on the rich prairie bottoms. During the dry season it produces but little seed, though it usually makes a good growth of root leaves. In the middle Atlantic States this grass seeds freely and the seeds are easily collected.

No. 24. *Andropogon provincialis* Lam. Big Blue-stem. (Fig. 8.)

A stout perennial, with erect, more or less branching, and often bluish or glaucous stems, 2 to 6 feet high, long leaves, and flowers in short spikes, which stand two to five close together at the apex of the stem or its branches. These spikes are bluish or purple, sometimes pale green, and more or less hairy. This grass has



FIG. 8.—Big Blue-stem (*Andropogon provincialis*): a to g, details of the spikelet.

a wide range, extending over the United States east of the Rocky Mountains, and in the West and Northwest, particularly in the Missouri region, it is very abundant, and is highly valued for hay. It grows in a great variety of soils, and under extremely varying conditions of climate, and enters largely into the composition of the hay of the prairies. The early growth consists of a great abundance of long leaves, and if cut in early bloom the hay is readily eaten by horses and cattle, but if allowed to fully mature the stems become hard and woody and the hay produced is of inferior quality. Investigations of the seed production of this *Andropogon* indicate that it matures seed rarely. It is stated that a very favorable season of moisture is required to make it fruit abundantly. This lack of fertility, if really true, will be a serious obstacle to the general propagation of the grass by the usual and convenient method of seeding.

No. 25. *Andropogon saccharoides* Swz. Feather Sedge-grass.

A variable grass, growing to the height of 1 to 3 feet, with narrow, silvery-bearded panicles. Some forms of this species have been introduced into cultivation for ornament. It is a native of our Southwestern States and Territories, in some of its varieties extending southward to Chile, where it is regarded as one of the best pasture grasses of the Cordilleras.

No. 26. *Andropogon scoparius* Michx. Little Blue-stem. (Fig. 9.)

A rather slender perennial, 1 to 3 feet high, more or less branched above; the slender racemes are single and terminate the culm or its branches. This grass has a similar range to the Big Blue-stem, extending over nearly all of the United States east of the Rocky Mountains, and in the prairie regions it is nearly always found associated more or less abundantly with the Big Blue-stem and Bushy Blue stem. It is common in the mountain districts of the South, and is valued there for grazing. In the West it is cut for hay, but is not so much thought of as the Big Blue-stem. In South Dakota this is one of the most common grasses in the basins of the Bad Lands.

No. 27. *Andropogon sorghum sativus* Hack. Includes the cultivated varieties of sorghum.

Andropogon sorghum includes many varieties, a number of which have been recognized by some authors as distinct botanical species under the genus *Sorghum*; others, including Hackel, have referred them all to the genus *Andropogon*. Hackel has elaborately worked out the botanical characters of the species and characterized the known varieties, giving to each a technical name. It is not necessary here to follow

out his classification, which is apparently good. In the works of others there is much confusion in the botanical classification, and still more in the application of the common or English names. The same name has been applied to different varieties and the same variety has often been designated under various names. All the forms are of Eastern origin, and have arisen probably from a common stock through ages of cultivation. From varieties of this species are obtained grain, which furnishes nutritious food for man and domestic animals, particularly poultry. Sirup and sugar in commercial quantities are obtained from the saccharine varieties. The variety *saccharatus*, or Chinese sugar-grass, yields about 13 per cent of sugar. Brooms and brushes, used in all civilized countries, are made from the inflorescence of the variety known as broom corn, and all furnish fodder of more or less value for farm stock. In Africa alcoholic



FIG. 9.—Little Blue-stem (*Andropogon scoparius*).

drinks are prepared from the grains, and useful coloring pigments are contained in the fruiting glumes. The variety known as Kafir corn (Pl. I, fig. 2), which grows to the height of 4 or 6 feet, has been cultivated with great success as a fodder plant in the semiarid regions of the West. In fact, all the sorghums will grow in drier climates or under more trying conditions of drought than Indian corn. They may be cultivated in much the same way as that cereal, but the seed may be planted more thickly. In chicken corn or white Egyptian corn (var. *cernuum*) the densely flowered panicle is abruptly bent or recurved, so that it points downward. This variety is largely cultivated in tropical and northern Africa and in some parts of southern Asia, where it is used as a cereal. It is occasionally grown in this country, the seed being prized as food for poultry. The varieties adapted for the production of fodder or silage are particularly valuable for cultivation in the South and Southwest. The amount of fodder produced is often very large, of excellent quality, and there are few among the larger grasses better adapted for soiling. Yellow Milo Maize, White Milo Maize, and Jerusalem Corn, non-saccharine varieties of *Andropogon sorghum*, are grown both for fodder and for the seed, particularly in the Southwestern States.

No. 28. *Andropogon squarrosus*. Linn. fil. Vetivert.

A stout perennial, 4 to 6 feet high, with strong, fibrous, and highly fragrant roots. A native of India, occurring also in some of the West India Islands and Brazil, growing in marshes and on river banks. Introduced into Louisiana many years ago, and now spontaneous in some of the lower parts of that State. Cultivated successfully at Knoxville, Tenn., where the fragrance of the rhizomes and roots was developed to a marked degree, but the plants did not bloom. In India this grass is largely used for thatching, and is woven into mats, which serve as screens or shades for doors and windows (tatties), awnings, covers for palanquins, and fans, and brushes used by weavers in arranging the thread of the web are made from either the roots or the whole plant. The roots, laid among clothing, impart a pleasing fragrance to the garments and are said to keep them free from insects. Fans made from the root fibers were among the articles on sale at the World's Fair in the Javanese bazaar. The roots are an article of commerce sold by druggists. In European drug stores the roots are known as *Radix anatheri* or *Radix vetiveræ*, a stimulant or antiseptic. They yield a perfume known as *vetivert*, or, in India, *itar*.



FIG. 10. — Broom Sedge
(*Andropogon virginicus*).

No. 29. *Andropogon virginicus* Linn. Broom-sedge. (Fig. 10.)

A rigidly erect perennial, 2 to 4 feet high, bearing a narrow, elongated, and loosely-branched panicle of silky-bearded racemes. The stems are strongly flattened near the base, and at maturity they are too hard and woody to be eaten by stock or to be of any value for hay. When young, however, this grass affords most excellent grazing. Milch cows fed upon it are said to yield butter of superior quality. There is probably no native grass better known to the farmers of the South than this, and although possessing some value, as here indicated, it is, broadly speaking, one of the worst weeds of that section, interfering seriously with the formation of permanent meadows. Constant tillage or very close grazing appears to be the only means of keeping this grass from occupying the land.

No. 30. *Anthoxanthum odoratum* Linn. Sweet Vernal-grass. (Fig. 11.)

A perennial, early-flowering, sweet-scented grass, introduced into this country from Europe, and now widely distributed over the Eastern and Central States. It is an inferior fodder grass, but owing to its earliness it possesses some value in mixtures for pastures, and its sweet scent adds a pleasing fragrance to hay, of which it should form only a small percentage. The leaves have a bitter taste, and the grass is apparently unpalatable to stock, for they will not readily eat it. It is regarded as a serious pest in New Zealand. The stems have been used

in the manufacture of imitation Leghorn hats. Average number of grains in 1 pound of pure seed, 924,000. Price of seed quoted in New York catalogues, \$6 per bushel. Weight per bushel, about 10 pounds.



FIG. 11.—Sweet Vernal-grass (*Anthoxanthum odoratum*): a, spikelet; b, floret; c, androgynium.

No. 31. *Aristida fasciculata* Torr. Needle-grass. (Fig. 12.)

Needle-grass grows from 6 inches to a foot high, and is a native of the arid regions, from Montana southward to Texas, where it is particularly abundant in poor soils, and presents a great variety of forms. It is usually found in dry, gravelly soils on the plains, mesas, and foothills. In the Eastern and Middle States the species of *Aristida* are deemed of little or no value, but in the Southwest, where every mouthful of fodder of any sort has value, they are not wholly worthless. *Aristida schiedeana* and *A. bromoides*, growing upon rocky and desert soil in Arizona and New Mexico, supply in their thin, scattered tufts "dainty bits seized upon by stock with avidity." (Pringle.)

No. 32. *Aristida stricta* Michx. Wire-grass.

This is one of the "wire-grasses" of the Southern States, growing to the height of 2 or 3 feet. The simple stems are terminated by a narrow panicle, usually a foot in length. It is common along dry, sandy ridges and in the pine barrens.

No. 33. *Arrhenatherum elatius* (L.) M. & K. Tall Oat-grass. (Fig. 13.)

A loosely tufted perennial, 2 to 4 feet high, introduced from Europe as a fodder grass and now quite generally distributed over the regions east of the Mississippi. In Europe it is regarded as one of the best meadow grasses, but is not recommended for pastures. It does well in the Southern States, where it is frequently cultivated, and is valued both for winter grazing and for hay. In California it is spoken of in the highest terms, particularly for its drought-resisting qualities. It does not form a very compact turf, and when sown should be mixed with other grasses. It grows rapidly, blooms early, and when cut dries out readily. It is not suited to heavy, moist soils, but thrives best on loamy sands or loams. It produces a large yield, and on good soils three or four cuttings may be

obtained during the season. It is best sown in the spring, but in the Southern States it may be sown in September to advantage. In New Zealand this grass is spoken of as fast becoming a weed in mixed pastures; and, further, it is stated that the early growth is much relished by stock, but later in the season it is not touched. On rich, clayey loam this grass has made a yield of 17,015 pounds of green fodder, 6,380 pounds of hay, and 13,612 pounds of green aftermath per acre. When sown alone, the amount of seed to sow per acre is 5 to 6 bushels. Owing to the structure of the seed, it may be sown deeper than most other grasses. Average number of grains in one pound of pure seed, 159,000. Price of seed, quoted from New York catalogues, \$3.25 per bushel, or \$18 per 100 pounds.

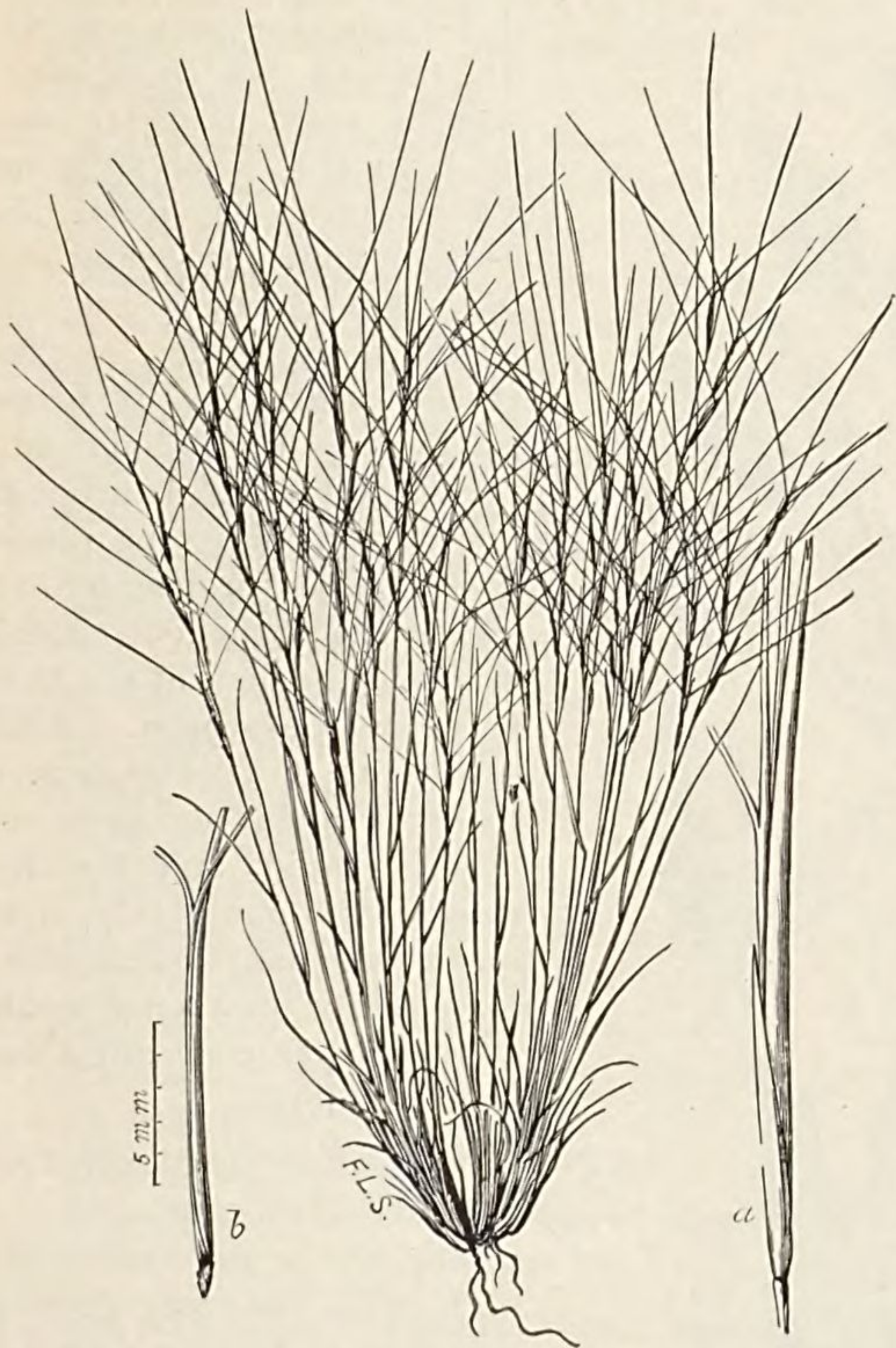


FIG. 12.—Needle-grass (*Aristida fasciculata*): *a*, spikelet; *b*, indurated flowering glume, the awns cut off.



FIG. 13.—Tall Oat-grass (*Arrhenatherum elatius*).

No. 34. *Arundinaria macrosperma* Michx. Cane. (Fig. 14.)

This is the bamboo which forms the well-known canebrakes of the South. It is perennial, with woody stems 10 to 30 feet high, and evergreen leaves, which furnish a valuable supplement to the winter pastures. The plant blooms but once, and when the seeds mature the cane dies. The canes are used for many purposes, such as fishing rods, scaffolds for drying cotton, splints for baskets, mats, etc. Attempts made to cultivate this grass have not been successful.

No. 35. *Arundinaria tecta* (Walt.) Muhl. Small Cane.

This is regarded by some as only a variety of the cane mentioned above, but it is of smaller growth, rarely exceeding 10 feet in height, and extends as far north as Maryland. It forms extensive "canebrakes" in many parts of the Southern States, and its perennial leafage, together with the younger stems and branches, supply forage for thousands of cattle during the winter season. This fodder,

however, does little more than sustain the life of the animals. It is of little or no value for fattening cattle or for milch cows.

No. 36. *Arundo donax* Linn. Reed.

A tall, leafy perennial, attaining the height of 10 to 15 feet, or in very favorable locations even 30 feet. The leaves are broad and widely spreading and the stems are leafy to near the top. The panicle has some resemblance to that of pampas grass, but is not so large. This grass is grown for lawn decoration and to conceal unsightly objects. It is a native of southern Europe, northern Africa,

and western Asia, and is said to be spontaneous along the Rio Grande. In some countries the stout stems are used for laths and, when split, for woven work; the leaves are used for thatch or roofing, and the stout rhizomes are employed as a diuretic. A cultivated variety has its broad leaves striped with longitudinal white bands. It presents a very striking appearance. This grass is propagated by transplanting the roots, which work may be done at any time during the season. After growth has fairly commenced the subsequent development is very rapid, and for this reason it is one of the most important plants of its class for quickly producing scenic effects or for concealing unsightly objects.



FIG. 14.—Cane (*Arundinaria macrosperma*): a, floret; b, palea and lodicules; c, grain.

fattening properties. If cut just when coming into bloom, it makes excellent hay. The seed is produced in abundance, and is easily collected. This may prove a valuable grass for the semiarid districts of the Southwest. The seeds of this grass, as well as those of the closely related *Astrebla triticoides*, were formerly used as food by the natives of Australia.

No. 37. *Astrebla pectinata* F. v. Muell. Mitchell-grass.

A smooth, erect grass, $1\frac{1}{2}$ to 3 feet high, with flat, long-pointed leaves and densely flowered terminal spikes or heads. It is a native of Australia, growing naturally upon the interior plains. It is regarded by the stockmen of that country as the best of all native grasses, both for its drought-enduring qualities and for its

No. 38. *Avena americana* Scribn. American Oat-grass.
In the grassy parks and on the foothills of the eastern slopes of the Rocky Mountains, this *Avena*, which closely resembles the *Avena pratensis* of Europe, is frequently found associated with the other native grasses. Where abundant it

makes a valuable addition to the grazing resources of the country. It is deserving of a trial under cultivation.

No. 39. *Avena fatua* Linn. Wild-oats. (Fig. 15.)

An erect annual, 2 to 3 feet high, with loose, open panicles, 8 to 10 inches long, the whole aspect of the plant closely resembling forms of the cultivated oat. The spikelets are larger, however, and the flowering glumes are covered with long, brown hairs, and have a twisted awn an inch in length. It is a native of the Mediterranean region, but is now widely distributed over grain-growing countries, and with the closely related *A. barbata* Brot. is especially common in California and Oregon, and has spread eastward to Minnesota. It is of rare occurrence in the Eastern States. By some this is supposed to be the original of the cultivated oat (*Avena sativa*), which is said to readily degenerate into it. *Avena fatua* is in most places regarded as a troublesome weed. When abundant in the grain fields, it occupies the place of better plants, and reduces the grade of the thrashed grain by the admixture of its inferior and lighter seeds. The stiff and twisted awns are injurious to stock, as they frequently cause irritation of the nostrils and mouths of the cattle feeding upon them. In California the young plants, before the bearded or awned spikelets mature, are esteemed for grazing and forage. "The use of the Wild-oat, with its brown, hairy seed and twisted awn, as an artificial fly by fishermen, is well known, the uncoiling of the awn when wetted causing those contortions by which it imitates a fly in trouble." (Hooker.) A form of the Wild-oat with the flowering glume smooth (var. *glabrescens* Coss.) is quite widely distributed on the Pacific Slope, where it has become a most troublesome weed in wheat fields.



FIG. 15.—Wild Oats (*Avena fatua*).

No. 40. *Avena pubescens* Linn. Downy Oat-grass.

This grass is similar in habit and appearance to *Avena fatua*, but is much less common. It is a European grass, and has thence been introduced into this country. It is occasionally found in the grain region of the Pacific Slope. The soils best suited to the growth of this grass are sandy loams, upon which it is valuable for early mowing and pasturage. Under favorable conditions it has produced 15,654 pounds of green fodder, or 5,870 pounds of hay, and 6,860 pounds of aftermath per acre.

No. 41. *Avena sativa* Linn. Oats.

A well-known erect annual, 2 to 4 feet high, with flat leaves and expanded panicles of rather large pendulous spikelets. There are many varieties, which have been divided into two classes, "panicle oats" with widely spreading panicle branches; and "banner oats" with the panicles somewhat contracted and one-sided. These two races are divided into "chaffy" and "naked-fruited" sorts; further varieties are established upon the color, form, or some special character of the grain. Oats have been cultivated from very early times in Europe, and they

form the principal grain of such northern countries as Norway and Sweden, and Scotland, and in these countries boiled oatmeal and oatmeal cakes are important articles of food. Boiled oatmeal is also much used in this country, especially at breakfast. The grain, however, is principally cultivated here as food for horses. In the Southern States, oats, particularly winter oats, are largely grown for forage. Sown in August, they furnish the best grazing from October to the latter part of April, and will then yield a more certain and a larger crop of grain than spring-sown oats. They are often cut green for soiling and for hay. Oat hay is quite extensively used in the South and in California. The practice is to cut when the grain is in the "dough" stage, or when the straw commences to turn yellow below the head and the leaves are still green. The yield ranges from 3 to 4½ tons per acre, according to the variety and the season. The feeding value of oat hay is higher than that of timothy, containing about 8.8 per cent of crude protein, and 55 to 65 per cent of fat formers, while the latter (timothy) contains from 5 to 7 per cent crude protein, and 45 to 55 per cent fat formers. Among the cereals, oats are the most nutritious, but oaten flour lacks the gluten of wheat, rendering the making of bread from it impossible. Oatmeal is richer in nitrogenous matter than soft wheats, and contains more fat than any of the other grains. Russian "quas" beer is made from oats.

No. 42. *Avena sterilis* L. Animated Oats.

A stout, oat-like grass, with one-sided panicles, and very large, awned spikelets; the awn is very long, twisted, and "kneed" or geniculate. It is the twisting and untwisting of these awns when exposed to changes of moisture and dryness that has given to this grass the common name of "animated oats." The untwisting or coiling-up of the awn causes the spikelets to tumble about in various directions, suggestive of independent motion or life-like activity.

No. 43. *Bambusa*. Bamboo.

The bamboos belong to the *Bambuseæ*, a tribe of grasses numbering about 175 species, chiefly limited to South America, southern and eastern Asia, and the East Indies. There are no European species, and only two in North America (see *Arundinaria*). Of the whole number of species only one is common to both hemispheres. The largest bamboos attain a height of 120 feet, with a diameter of a foot or more. A South American species has leaves 3 to 12 inches wide and 5 to 15 feet long. In India are extensive bamboo forests, and in countries where these grasses abound they are employed for many purposes. They furnish material for the complete construction and furnishing (including domestic utensils) of houses. They are used in shipbuilding and in the construction of bridges. Buckets, pitchers, flasks, and cups are made from sections of the stems. Baskets, boxes, fans, hats, and jackets are made from split bamboo. Ropes and Chinese paper are made from these grasses. A Chinese umbrella consists of bamboo paper, with a bamboo handle and split bamboo for a frame. The leaves are used for packing, filling beds, etc., and occasionally serve as fodder for stock. The young shoots serve as a vegetable. Tabashir, or bamboo manna, a silicious and crystalline substance which occurs in the hollow stems of some bamboos, is regarded as possessing medicinal properties. Good drinking water collects in quantities in the hollows of the internodes of many of the larger bamboos. All sorts of agricultural implements, appliances for spinning cotton and wool or for reeling silk, are often constructed entirely from bamboo. Very many articles of household use or decoration made from bamboo have become articles of commerce in Europe and this country. So many and varied are the uses of the several species of bamboo, that it is possible to mention here only a small part of them. Bamboos are propagated by seed, but more often by cuttings. Plants from the seed do not attain a sufficient growth to admit cropping under 10 or 12 years.

No. 44. Beckmannia erucæformis (L.) Host. Slough-grass. (Fig. 16.)

A stout, erect, subaquatic perennial, 1 to 4 feet high, with narrow, densely flowered panicles. The leaves are broad and flat, and the stems are coarse but tender, becoming somewhat woody when old. It grows along the banks of streams and rivers and frequently follows the course of the irrigating ditches. When young, however, this grass is palatable and readily eaten by stock. In some portions of the Northwest, to which region this grass is confined in this country, it often occurs in such quantities as to constitute an important part of the forage of low pasture lands. It may be recognized by the peculiar, spike-like branches of the panicle, which have some resemblance to the rattles of a rattlesnake, and for this reason it is sometimes called "Rattlesnake-grass." It is deserving of trial under cultivation for low meadow lands in the more Northern States, and is especially adapted to irrigated alkaline lands.

No. 45. Bouteloua curtipendula (Mx.) Torr. Side Oats. (Fig. 17.)

This is among the tallest of our species of *Bouteloua*, the rather stout, tufted stems being from 1 to 3 feet high. It has tough, perennial, fibrous roots, flat, long-pointed leaves, and many short spikes arranged along the upper portion

of the stem. Its range extends from New Jersey westward to the Rocky Mountains and southward through Texas into Mexico. Where abundant, it is said to make fair hay, and the numerous root leaves afford good pasturage. The hay is readily eaten by stock, but on the range cattle show a decided preference for Blue Grama. Several species of Grama have been successfully grown in small cultures at some of the experiment stations, but none of them, although apparently most valuable as pasture grasses for the semiarid regions, have been introduced into general cultivation.

No. 46. Bouteloua eriopoda Torr. Black Grama.

This is one of the species of Grama so valuable for grazing in New Mexico and Texas. The slender stems are 1 to 2 feet high, and from its thrifty habit of growth it forms dense and excellent pasturage wherever it grows abundantly. It is a common grass along the Rio Grande and in the region between the Pecos and the Gila; also in the Olympia, Guadalupe, and Eagle mountains, and on the Staked Plains in Texas. The woolly-jointed stems at once serve to distinguish this from the allied species of *Bouteloua*.

No. 47. Bouteloua oligostachya (Nutt.) Torr. Blue, or White Grama. (Fig. 18.)

This is one of the most abundant and most valued of the Grama grasses, and extends from Wisconsin westward to California, and southward into Texas and northern Mexico. It is a perennial, 6 to 18 inches high, its strong rhizomes and numerous



FIG. 17.—Side Oats (*Bouteloua curtipendula*).



FIG. 16.—Slough-grass (*Beckmannia erucæformis*).

root-leaves forming dense and more or less extensive patches of excellent turf. In Montana it is known as Buffalo-grass. It frequents the bench lands of that State, growing at elevations of from 3,000 to 4,000 or 5,000 feet, and not infrequently covers wide areas. No other grass better withstands the tramping of stock, and it is unsurpassed for grazing purposes. In the early days in the Southwest it formed a large proportion of the hay delivered at the various military posts and stage stations, and was considered the best obtainable there. Like the true Buffalo-grass, it cures during the dry season in the turf into perfect hay, losing none of its nutritious properties.

No. 48. *Bouteloua polystachya* Torr. Low Grama.

This is a small, slender grass, of good quality. It is one of the smallest of the Gramas, and only occurs sparingly here and there in scattered tufts. It rarely exceeds 6 inches in height, and is confined to the arid regions of the Southwest.



FIG. 18.—Blue, or White Grama
(*Bouteloua oligostachya*).

No. 49. *Bouteloua repens* (HBK.) Scribn. Creeping Grama.

A common grass in the vicinity of Acapulco, Mexico, where, according to Dr. E. Palmer, it occurs on the highest mountains and down their stony slopes to the water's edge. Greedily eaten by stock.

No. 50. *Bouteloua texana* Watson. (Seed Mesquit.)

This is a small but excellent grass, common about San Antonio and at other points in Texas, chiefly along the Rio Grande. It is recognized as an important grass in the stock ranges.

No. 51. *Brachypodium japonicum* Miq. Japanese Wheat-grass.

A promising Japanese perennial, closely resembling Bearded Wheat-grass (*Agropyron caninum*), but of rather stronger growth. It was introduced into California by the Agricultural Experiment Station of the University of California, at Berkeley, from New Zealand, in 1886, and the first seed was distributed in California in 1889. It has been cultivated with success at a number of points in California and at several of the experiment stations in the East. In the Southern States it is regarded as a valuable grass for winter grazing, as it makes its best growth during the cooler months.

No. 52. *Briza media* Linn. Small Quaking-grass. (Fig. 19.)

An erect perennial, from 1 to 2 feet high, introduced into this country from Europe because of its pleasing ornamental appearance. It has escaped from cultivation in many places, and has become sparingly naturalized. It is occasionally cultivated for ornament; the nodding panicles of rather showy spikelets are used for winter bouquets. It is but little known here, but is classed as a valuable meadow grass in Middle Europe and is recommended as an admixture for pastures on dry, thin soils. *Briza minor* is a smaller and more delicate annual species, also cultivated occasionally as an ornamental and for dry bouquets. *Briza maxima*, also an annual, is a larger ornamental species.

No. 53. *Bromus ciliatus* Linn. Swamp Chess.

A native perennial of wide range, frequent in open woodlands, growing to the height of 3 to 5 feet. It is leafy to the top, and would doubtless make a hay grass of

good appearance, although of somewhat inferior quality. No attempts have been made to cultivate it for agricultural purposes. It makes a vigorous early growth on good soils and is recommended for propagation in wooded parks and woodland pastures.

No. 54. *Bromus inermis* Leyss. Smooth Brome-grass. (Fig. 20.)

An erect perennial, 2 to 5 feet high, with strong creeping rootstocks, and a loose open panicle, 4 to 6 inches long. A native of Europe introduced into this country by the Agricultural Experiment Station of the University of California about 1880, which gives considerable promise of value both for hay and pasturage. It is strongly stoloniferous, and quickly makes a thick, firm turf. It appears to grow with equal vigor in Canada and in Tennessee, remaining green throughout the winter season in the latter State. The strong perennial character of



FIG. 19.—Small Quaking-grass (*Briza media*).

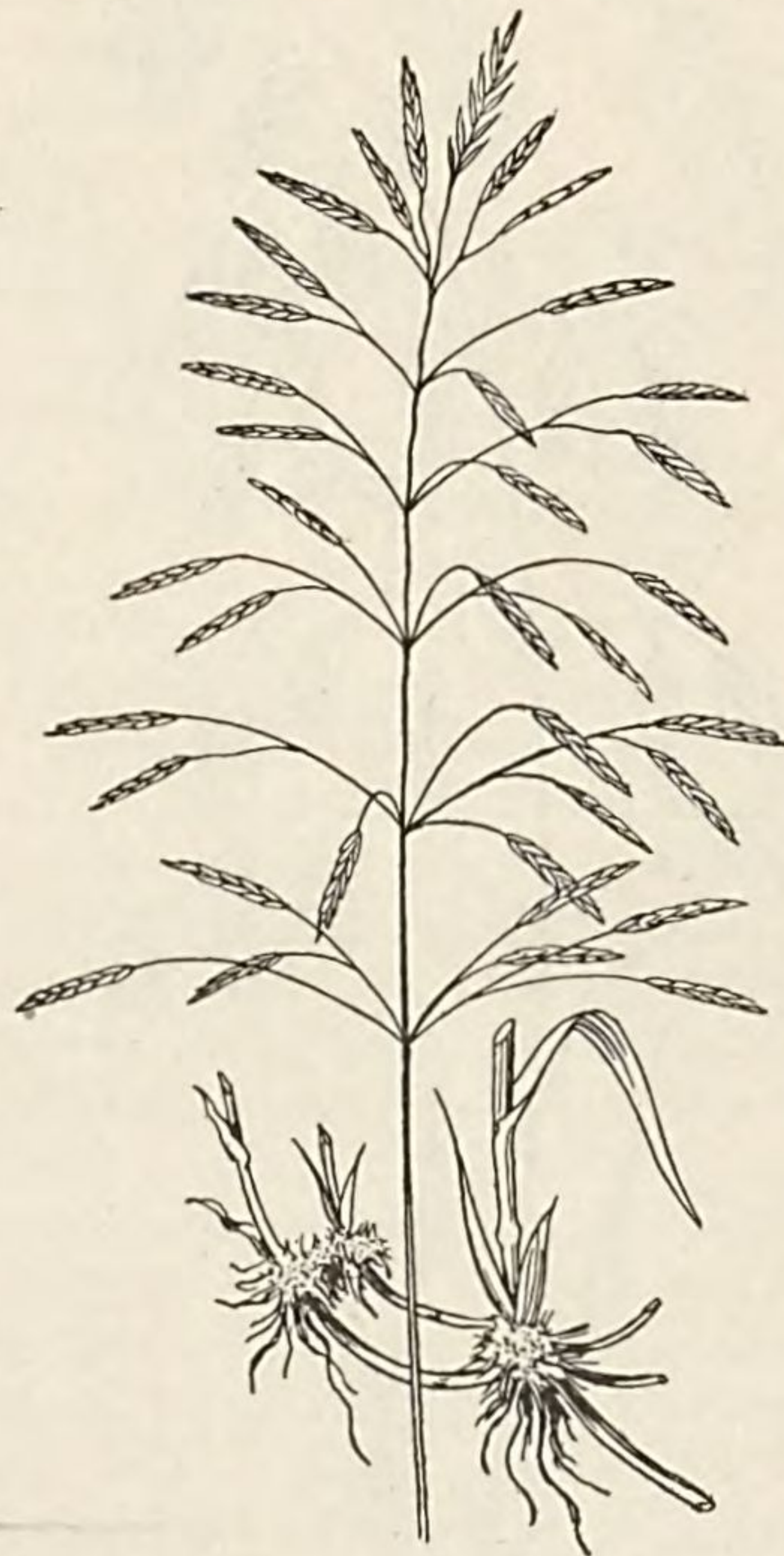


FIG. 20.—Smooth Brome-grass (*Bromus inermis*).

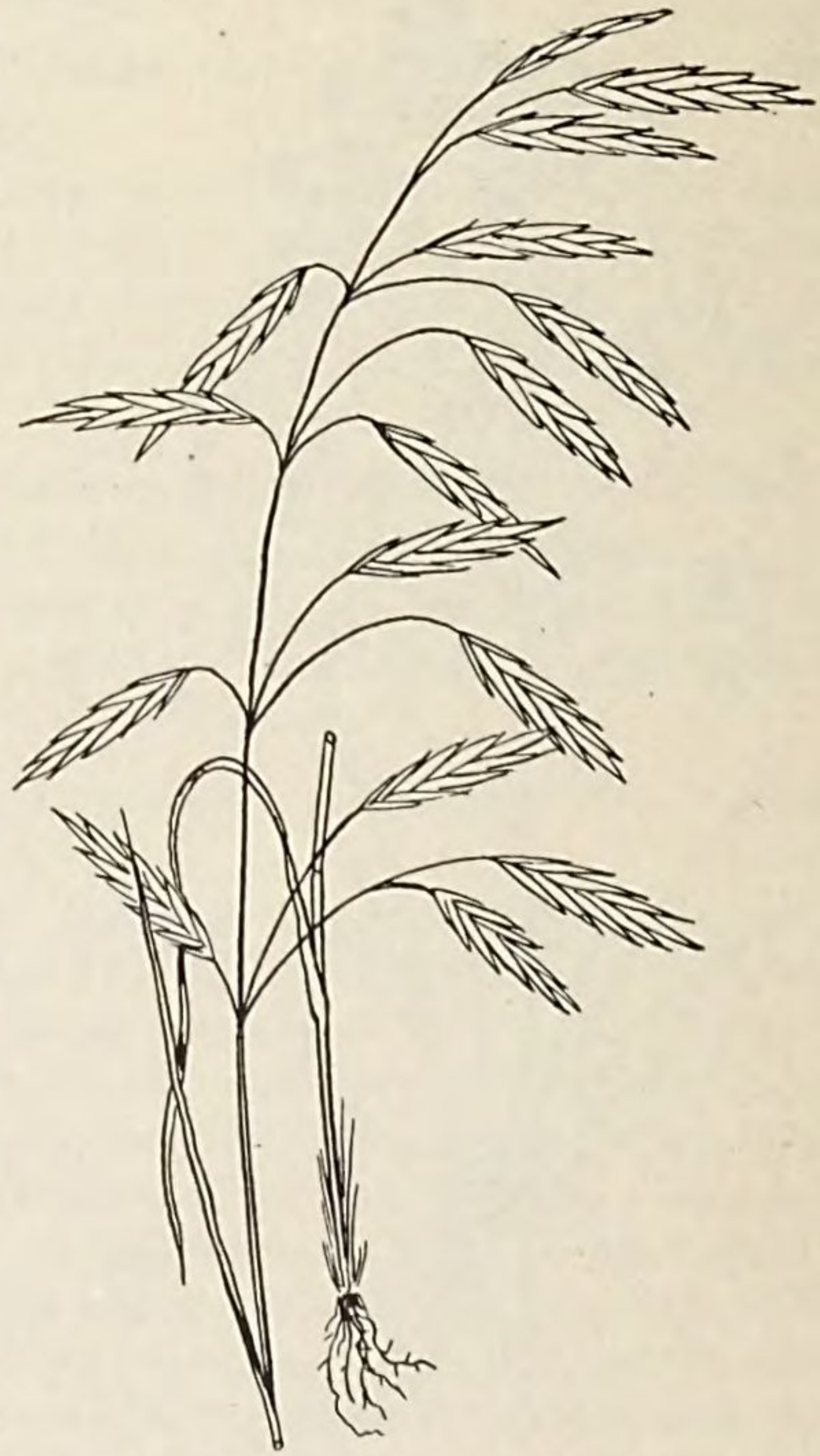
this Brome-grass and its unusual drought-resisting powers are qualities which recommend it for general cultivation, particularly in the semiarid regions of the West and Northwest. It thrives well on dry, loose soil, but of course the better the soil the greater the yield. Its nutritive value is comparatively low, and before undertaking its cultivation the fact should be remembered that it is somewhat difficult to eradicate when once established, although by no means so difficult as Couch-grass or Johnson-grass. In Europe it is classed among the best hay grasses. The seeds are quoted in New York catalogues at from \$20 to \$22 per 100 pounds. A bushel weighs about 14 pounds. Sow three bushels to the acre if sown alone. In this country the yield of seed per acre has been 600 pounds, which at the prices named would make it a very profitable crop. Professor Fletcher, of Canada, reports a yield of $3\frac{3}{4}$ tons of hay per acre.

No. 55. *Bromus pumpellianus* Scribn. Western Brome-grass.

A native of the Northwestern States in the Rocky Mountain region, extending into Canada. In habit of growth it closely resembles Hungarian, or Smooth Brome-grass (*B. inermis*), and is doubtless equally valuable. Prof. James Fletcher, who has cultivated this grass at the experiment station at Ottawa, Canada, says, "This is a very valuable grass, producing an abundance of leaves, continuing in flower for a long time, and giving a heavy aftermath."

No. 56. *Bromus racemosus* Linn. Upright Chess.

An introduced annual, 1 to 3 feet high, with more or less spreading and nodding panicles and smooth spikelets. This is a very common grass in cultivated fields and waste places, and is often mistaken for Chess, from which it differs chiefly in its narrower panicles and straight awns, which are nearly as long as the

FIG. 21.—Chess (*Bromus secalinus*).FIG. 22.—Rescue-grass (*Bromus unioloides*).

flowering glumes. This grass has become very common in certain sections, particularly in the South. A field of it presents an attractive appearance, and the hay produced is of good quality.

No. 57. *Bromus secalinus* Linn. Chess; Cheat. (Fig. 21.)

A well-known, weedy, annual grass, introduced into this country many years ago, and now common in grain fields and waste lands. The panicle is spreading and more or less drooping, and the awns of the flowering glumes are usually much shorter than the glumes themselves and more or less flexuose. The idea that Cheat or Chess is degenerated wheat has no foundation whatever in fact. Only Cheat seeds will produce Cheat, and it is certain that wherever these plants appear they were preceded by Cheat seeds, which may have been introduced with the grain sown, or brought by birds or animals from other fields. Cheat and wheat are only remotely related; they belong to quite distinct tribes in the grass

family; wheat is less likely to change into cheat in a single generation than into the more nearly allied oats, or than wheat is to change into barley, with which it is very closely related.

No. 58. *Bromus unioloides* Willd. Rescue-grass. (Fig. 22.)

This *Bromus*, which is a native of South America, and probably also of the extreme southwestern portion of the United States, is a strong-growing grass, with rather broad, much flattened, usually bearded spikelets. It grows to the height of 1 to 3 feet, and in the more vigorous plants the branches of the nodding panicle are widely spreading. It grows rapidly, seeds freely, and dies after seeding. If, by frequent mowing or close grazing, it is prevented from going to seed, its duration may be continued over two or three years or more. If the seeds are allowed to fall, as they frequently do when mature, young plants soon appear, and a fairly continuous growth of this grass may thus be maintained. In many parts of the Southern States, where it has been most cultivated, it has come to be regarded as one of the best winter grasses, as it makes its chief growth during the cooler months of the year. Sow in August or September, at the rate of 30 to 40 pounds to the acre.



FIG. 23.—Buffalo-grass (*Bulbilis dactyloides*). *a*, female plant; *b*, male plant.

No. 59 *Bulbilis dactyloides* (Nutt.) Rafin. Buffalo-grass. (Fig. 23.)

This is the true Buffalo-grass of the Great Plains region, which is reported to have been much more abundant and more widely distributed in times past than it is at present. Now, however, it is known to extend from the British Possessions southward into Texas, where it is considered an invaluable grass and one of the best constituents of sheep pastures. It has a low habit of growth, rarely more than 5 or 6 inches high, and produces numerous creeping and widely spreading branches or stolons, which root at the joints, each joint forming a new tuft, and in this way the grass often covers large areas with a close mat of fine-leaved herbage, which is greatly relished by all grazing animals. As a winter forage, it is without an equal. The habit of growth of this plant is very similar to that of Bermuda-grass, but the stems and leaves are much finer and the turf formed more compact. Live roots transplanted from Nebraska to the grounds of the Department of Agriculture at Washington, D. C., have grown with remarkable vigor, and it may be possible to utilize this most palatable and nutritious grass in portions of the Eastern or Southern States.



FIG. 24.—Blue-joint (*Calamagrostis canadensis*).

No. 60. *Calamagrostis canadensis* (Michx.) Beauv. Blue-joint. (Fig. 24.)

A native grass common in the Northern and Northwestern States, extending clear across the continent, usually growing in moist meadows. The leafy stems are 3 to 5 feet high, and the open brown or purplish panicles have some resemblance to those of Redtop. Occasionally it is

found occupying considerable areas to the exclusion of other grasses, and under such conditions it yields a large amount of excellent hay, highly prized by farmers and eaten with avidity by all farm stock. This grass grows naturally on low, moist meadows, and has succeeded well under cultivation. In the northern portion of the United States its more extended culture for hay is recommended.

No. 61. *Calamagrostis cinnoides* (Muhl.) Spreng. Reed Bent-grass.

A stout, reed-like grass, 3 to 5 feet high, not infrequent in low, moist grounds and swamps, ranging from New England southward to Tennessee. No attempts have been made to cultivate it, and little is known of its agricultural value. Probably of some use for low woodlands where grasses are desired for pasturage, and if it will thrive in the open it would make a most excellent hay-grass for low meadows.

No. 62. *Calamagrostis hyperborea americana* (Vasey) Kear. Yellow-top.

A very common grass in low meadows and shady river banks throughout the Northwest. It affords a large amount of excellent hay if cut in proper season. A good grass for cultivation in moist, sandy meadows.

No. 63. *Calamagrostis neglecta* (Ehrh.) Gaertn. Pony-grass.

A rather slender, erect perennial, with narrow leaves, and a contracted, densely flowered, brownish panicle, 3 to 6 inches long. A native of Northern Europe and North America, ranging along our northern borders from Newfoundland and Maine to the Pacific, being most abundant in the Rocky Mountain region. Under experimental cultivation it has succeeded well. It is a productive grass, much liked by stock, especially horses, and is deserving a place among the cultivated species.

No. 64. *Calamagrostis suksdorfii* Scribn. Pine-grass.

A rather slender, erect grass, 2 to 3 feet high, with smooth stems, narrow leaves, and contracted, usually pale, straw-colored panicles. A common grass in the Northwest, growing in low pine woods or on moist mountain slopes. It is said to be one of the most common grasses in Washington, and it presents all the qualities of an excellent hay or pasture grass.

No. 65. *Calamovilfa longifolia* (Hook) Scribn. Sand-grass. (Fig. 25.)

A stout, long-leaved grass, 1 to 4 feet high, growing in sands or sandy soil along the shores of the Great Lakes and in the Missouri region of the West, extending southward to Kansas. Its very strong and far-reaching rhizomes or creeping "roots" make this an exceedingly valuable grass for binding drifting sands, or those subject to wash by swift currents or the beating of the waves. As a sand binder for interior regions of the country this grass is probably unsurpassed. Its long, tough leaves suggest a possible value for paper making.



FIG. 25.—Sand-grass (*Calamovilfa longifolia*).

No. 66. *Campulosus aromaticus* (Walt.) Scribn. Toothache-grass. (Fig. 26.)

A perennial grass with erect stems 3 to 4 feet high. Native of the Southern States from Virginia southward, growing in the wet pine barrens, possessing no agricultural value, but rather curious in appearance. The strong rootstocks are lemon-scented and have a pungent taste.

No. 67. *Cenchrus echinatus* Linn. Cock-spur.

A rather stout annual, with branching culms 1 to 2 feet long, and dense heads or spikes made up of 20 or more globular, spiny burs containing the spikelets. It is a weed of the fields and waste places of the Southern and Southwestern States.

No. 68. *Cenchrus tribuloides* Linn. Sand-bur. (Fig. 27.)

A widely distributed grass growing in sandy soils along river banks, the seashore and more or less scattered throughout the interior of the country in sandy districts. It is one of the worst of annual weeds wherever it becomes abundant. The prostrate branching stems are 1 to 2 feet long; the spikes are composed of 10 to 15 strongly spiny burs, which readily become detached and adhere to passing objects. No pains should be spared in efforts to exterminate this grass wherever it makes its appearance.

No. 69. *Chætochloa glauca* (Linn.) Scribn. Yellow Foxtail. (Fig. 28.)

An erect annual, 1 to 2 feet high, with flat leaves, and a bristly, cylindrical, spike-like, densely flowered panicle 1 to 3 inches long. This grass is widely distributed throughout the tropical and warmer temperate regions of the world, grow-



FIG. 26. — Toothache-grass
(*Campulosus aromaticus*).



FIG. 27. — Sand-bur (*Cenchrus tribuloides*).



FIG. 28. — Yellow
Foxtail (*Chætochloa glauca*).

ing as a weed in cultivated grounds. It is especially common in the Southern States, where it continues to bloom throughout the season, from June to October. It is distinguished from *Setaria viridis* by its somewhat larger spikelets and more widely spreading yellowish bristles.

No. 70. *Chætochloa italica* (Linn.) Scribn. Millet; Hungarian-grass. (Fig. 30.)

This grass, in some of its varieties, has been cultivated in the East for many centuries, and in some parts of India and Trans-Caucasia it still forms an important article of food. Its culture extends back to an early date in Egypt, and in the lake dwellings of the stone age it is found in such quantities that it must be regarded as the main bread supply of the prehistoric peoples (Hackel). In Europe and in this country it is cultivated to some extent for fodder and for the

seed, the latter being used chiefly for fowls. It grows rapidly, and may be cut within sixty or sixty-five days from the time of sowing. If used for fodder, it should be cut just as it begins to head, before blooming, for when more advanced it is apt to be injurious to stock fed upon it. When cut in good season it is one of the most valuable of soiling plants. German Millet, *Chætochloa germanica* (fig. 29), is only a variety of *Chætochloa italica*, distinguished by its smaller, more compact, and erect heads, the bristles of which are usually purplish. Sow 2 to 3 pecks per acre for hay. One peck is sufficient when sown for seed.

No. 71. *Chætochloa magna* (Griesb.) Scribn. Giant Millet. (Pl. II.)

This native millet grows in swamps along the coast from Florida to Delaware. The leaves are very broad and long, and the stems are often 8 or 10 feet in height. It is one of the most promising grasses for use in the reclamation of swampy



FIG. 29.—German Millet (*Chætochloa germanica*).

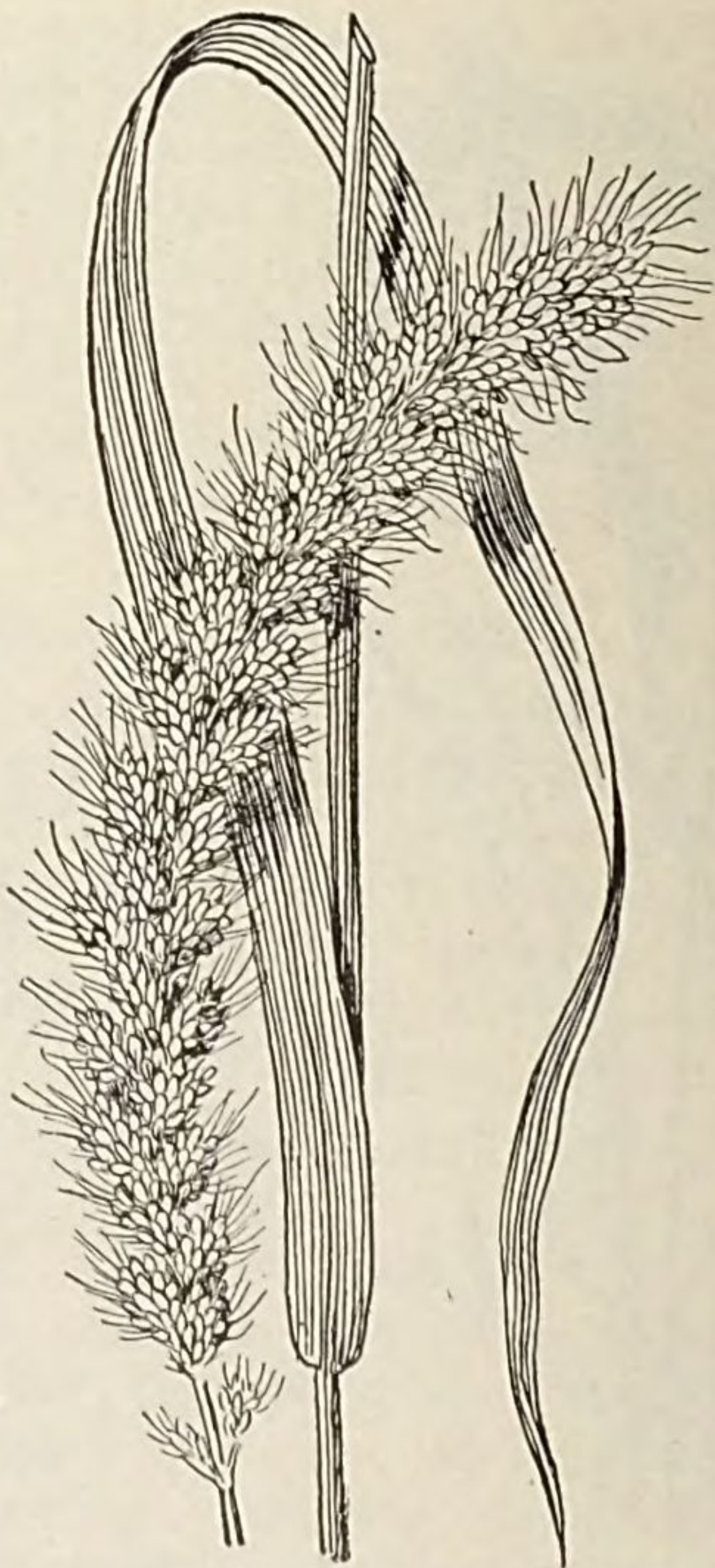


FIG. 30.—Millet (*Chætochloa italica*).

lands along the coast. It has been grown successfully in the grass garden on the Department grounds. A single plant, with much branched stems, is shown in Pl. II.

No. 72. *Chætochloa verticillata* (Linn.) Scribn. Bristly Foxtail.

Has about the same wide distribution as *Chætochloa glauca*, but is much less common in the United States. It is rarely found except in waste town lots and about dwellings in the Atlantic States. The bristles in this species are barbed downward, on account of which the "heads" cling to clothing or other objects with which they may come in contact. A weed.

No. 73. *Chætochloa viridis* (Linn.) Scribn. Green Foxtail.

Similar in habit to *Chætochloa glauca*, with about the same distribution, and equally common in this country, appearing as a weed in all cultivated grounds. It



SINGLE PLANT OF NATIVE "GIANT MILLET" IN GRASS GARDEN OF THE U. S.
DEPARTMENT OF AGRICULTURE.

begins to bloom a little earlier than the Yellow Foxtail, the more numerous spikelets are smaller, the head or panicle less erect, and the bristles usually green, not yellow, as in that species. The stems are very tough and may be utilized for making paper.

No. 74. *Chloris barbata* Sw. Bearded Crowfoot.

This and the very similar *C. elegans* of our Southwestern States and Territories are pleasing ornamental grasses, growing to the height of 1 to 2 feet, the main stem and branches being terminated by 3 to 10 bearded spikes, which impart to them a striking appearance and make them valuable ornamentals. *C. polydactyla*, a West Indian species which has been found in southern Florida, is equally attractive, and has longer and more graceful spikes. *C. barbata* appears to be the only one generally cultivated, but there are several native species which are quite as ornamental. *C. gracilis*, a native of Central America and Mexico, is another species occasionally cultivated for ornament.

No. 75. *Chloris glauca* (Chapm.) Vasey. Smooth Chloris. (Fig. 31.)

A strong-growing grass, with diffusely spreading and ascending stems, 2 to 4 feet long, bearing 10 to 25 slender terminal spikes. Native of Florida, growing on brackish marshes and along the borders of cypress swamps. This is a handsome species, well deserving the attention of the florist and although not at present recognized as possessing any agricultural value, it produces a large amount of comparatively tender herbage and may prove to be a desirable fodder plant for certain localities along the Gulf coast. It has made a good growth under cultivation on clayey soil at Washington, D. C.

No. 76. *Chloris verticillata* Nutt. Windmill-grass.

A low, spreading perennial, with upright flowering branches 6 to 20 inches high.

The small awned spikelets are in slender spikes, which are crowded near the apex of the stems, and become widely-spreading at maturity. This grass is common in many places in central Texas, New Mexico, Arizona, northward to Kansas, and by some is spoken of very highly as an excellent grass for grazing, and one not easily tramped out. The arrangement of the spikes gives the grass an odd and somewhat pleasing appearance, making it of some use as an ornamental species for gardens. It is a good turf-former.

No. 77. *Cinna arundinacea* Linn. Indian Reed.

A tall, leafy grass, 3 to 7 feet high, native and frequent in shaded swamps and damp woods or along streams in wet meadows. For such places it may possess some agricultural value, as it yields a large amount of excellent hay where growing abundantly.

No. 78. *Coix lacryma-jobi* Linn. Job's Tears.

This grass is a native of southern Asia, and is occasionally cultivated in this country

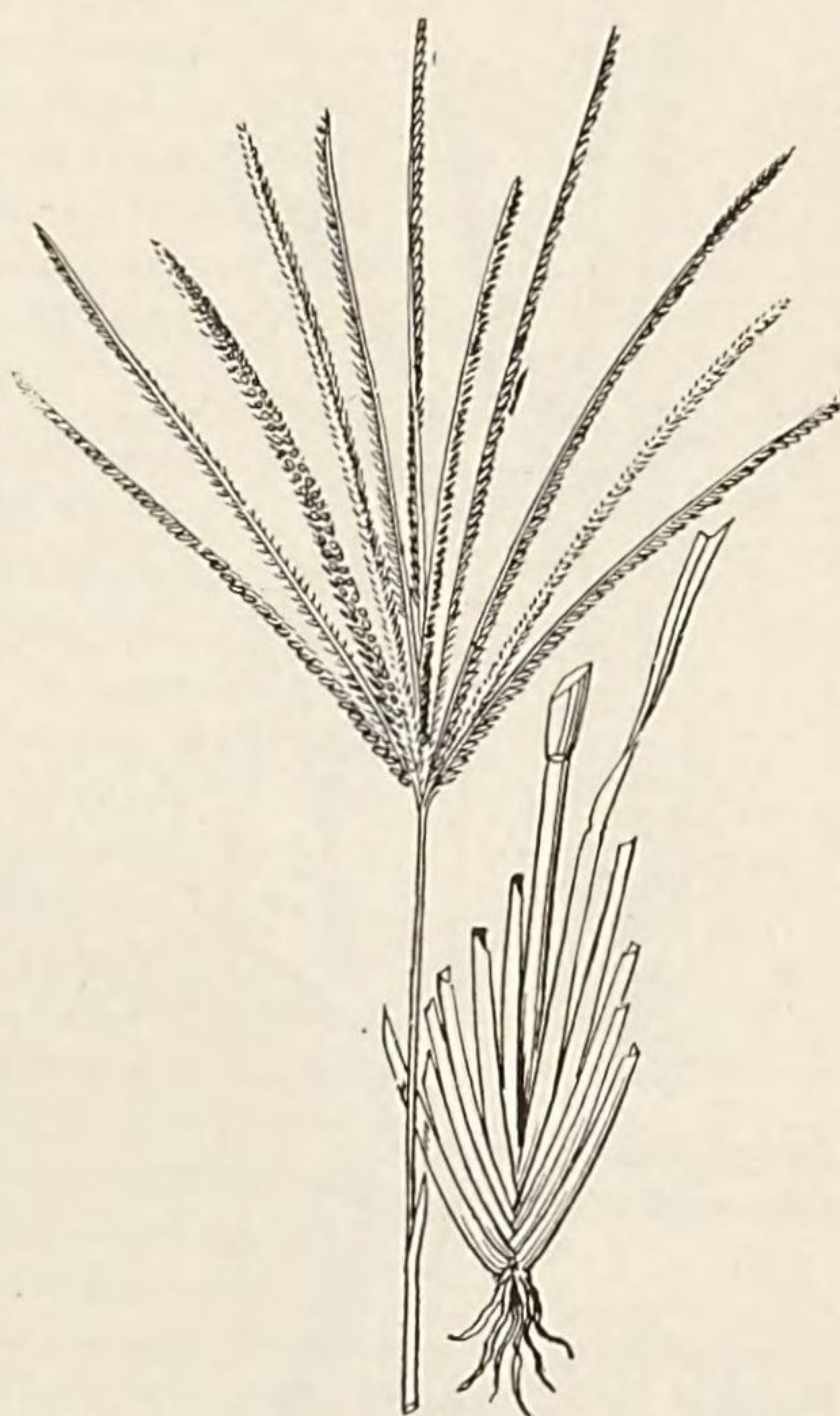


FIG. 31.—Smooth Chloris (*Chloris glauca*).

for ornament or as a curiosity. It is cultivated for food by some of the hill tribes of India, and supplies a staple article of diet of the Tankhul Nagas of Manipur. The female flowers of this grass are inclosed in a nearly globular, capsule-like covering, which is very hard and becomes nearly white with age. In some countries these capsules are used for dress ornamentation and by the Catholics for rosaries. In China this grass is cultivated to some extent, because the fruit is believed to be valuable as a diuretic and antiphthisis. It is a hardy annual, 2 to 3 feet high, with broad leaves and a curious, nodding inflorescence. The "seeds" may be obtained from any of the leading seedsmen.

No. 79. *Cynodon dactylon* Pers. Bermuda-grass. (Fig. 32.)

A grass widely dispersed over the tropical regions and warmer countries of the globe.

It has a creeping habit of growth, extending over the surface of the ground and

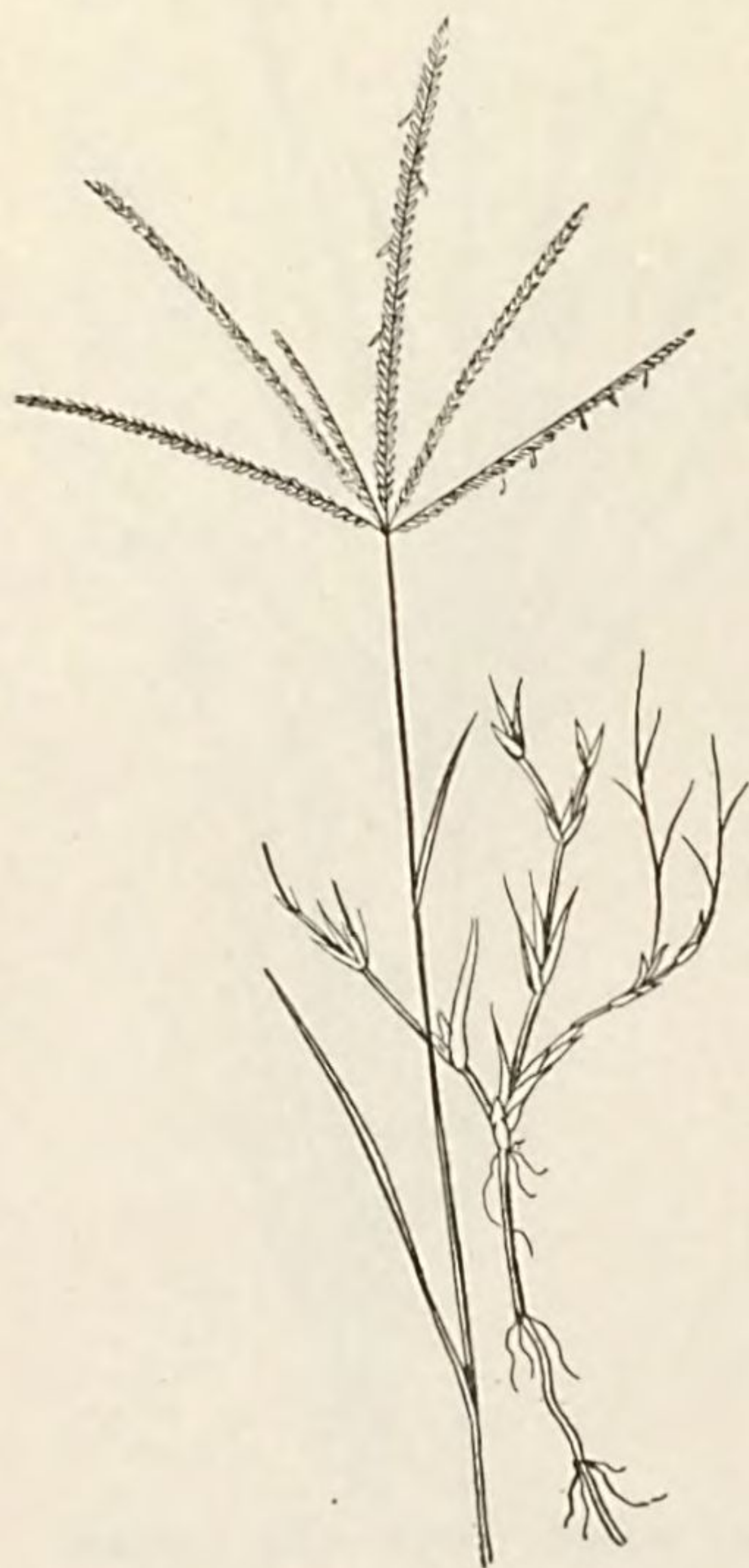


FIG. 32.—Bermuda-grass (*Cynodon dactylon*).

rooting at the joints. In poor soils the leaves are short and the upright flowering stems are only a few inches high, but on good land it grows to the height of 1 to 2 feet and yields a large amount of excellent hay. It may be cut three or four times during the season. In the Northern States it does not afford a profitable crop and is of little value for pasturage north of Virginia, but in the Southern States and in the warmer regions of the Southwest and on the Pacific slope it is cultivated extensively and is most highly prized, chiefly for grazing, all kinds of stock being exceedingly fond of it. It grows freely on sandy soils where other grasses will not thrive, and resists extreme drought and high temperatures. It is particularly a sun-loving grass, and will not thrive in the shade. It is useful for binding drifting sands and the loose soil of embankments or those subject to wash. It makes a pleasing lawn grass, and is extensively used for this purpose in the hotter portions of the United States, for it will thrive where the grasses ordinarily employed for lawns could not survive. The yield of hay under good conditions is from 3 to 4 tons to the acre, and as high as 10 tons to the acre have been produced under peculiarly favorable circumstances. While this grass will survive the winters of the latitude of Phila-

delphia, the leafage is very sensitive to cold and turns brown with the first frosts. This fact renders it objectionable as a lawn grass, except in regions where the winter season is very mild. In many portions of the Southern States there is probably no grass equal to Bermuda for summer pastures, and none which will better resist the trampling of stock. Bermuda does not mature seed except in the extreme southern portion of our country, but seed obtained from more southern latitudes is offered for sale by some of our leading seed dealers. The most direct and certain method of propagation is by transplanting, which may be effected by cutting up Bermuda turf into small pieces, scattering these along shallow furrows and covering them lightly. When once established, Bermuda grass is very persistent and difficult to eradicate, and it should not be introduced upon land which is likely to be used for other crops. New York catalogues quote the seed at \$1 to \$1.25 per pound, retail. In the vicinity of

Washington, D. C., Bermuda-grass is known as wire grass, and in Australia it is called Couch-grass.

No. 80. *Cynosurus cristatus* Linn. Crested Dog's-tail. (Fig. 33).

A slightly tufted perennial grass, 1 to 2 feet high, with fine and chiefly radical leaves. It is a native of Europe and is adapted to cultivation in moist, temperate regions, and has been sparingly introduced into this country. On moist, rich land it is fairly productive, but is rarely sown alone, excepting for seed or the formation of lawns, for which latter purpose it is well adapted, as it forms an even and compact sward when thickly sown. It is said to thrive well in the shade, a fact which gives it importance to those having shaded lawns. It forms a good bottom grass, has a highly nutritive value, and is recommended for all mixtures used for permanent pastures, especially in hilly regions. The mature stems of this grass are among the most valuable of those used in the manufacture of Leghorn hats. Number of seeds in a pound of pure seed is about 1,127,000. Price of seed in New York, 40 to 60 cents per pound, or \$7 to \$12 per bushel of 21 pounds.



FIG. 33.—Crested Dog's-tail (*Cynosurus cristatus*.)

No. 81. *Dactylis glomerata* Linn. Orchard-grass. (Fig. 34.)

This is one of the best known and most popular of our cultivated grasses. It will grow well on any soil containing a reasonable amount of fertility, excepting that which is very wet. It is a hardy grass and may be grown successfully anywhere in the United States, except in the extreme South and in the arid regions of the West. It yields an abundant crop of excellent hay, and may be sown alone for this purpose, but owing to its habit of forming tufts or tussocks, the land should be seeded heavily or the seeds should be mixed with other kinds, to act as fillers or bottom grasses. It is a good pasture grass, especially for open woodlands, and affords excellent grazing earlier than almost any other species. The aftermath is unequalled in amount by any of the grasses ordinarily cultivated for hay. When sown with other grasses, the tendency of Orchard-grass to form tussocks is much diminished and the sward greatly improved. Heavy rolling is also recommended for checking or preventing the tufted growth which this grass naturally assumes. By this operation the tufts are pressed down to the level of the other grasses and the turf becomes more uniform. In old, rich meadows of Orchard-grass it is advisable to harrow in the spring and afterwards use



FIG. 34.—Orchard-grass (*Dactylis glomerata*.)

the roller. Its best record of yield, made by Sinclair, was 27,905 pounds green, 11,859 pounds of hay, and 11,910 pounds of green aftermath per acre. Sow 3 to 4 bushels to the acre. The average number of grains in one pound of pure seed is 579,500. Price of seed, as given in New York catalogues, \$3 per bushel of 14 pounds. In England Orchard-grass is known as Cock's-foot.

No. 82. *Dactyloctenium aegyptium* (Linn.) Willd. Crowfoot-grass. (Fig. 35.)

This grass, which is a weed throughout all the warmer countries of the world, has become quite common in some of the Southern States. It closely resembles the more common Goose-grass or Duck's-grass (*Eleusine indica*), from which it differs chiefly in having the terminal spikes shorter and each tipped with a sharp prolongation of the axis. It is usually found in cultivated fields, and often in such abundance as to displace the less vigorous native sorts, and is sometimes cut for hay. In parts of Africa, where this grass is common, a decoction is prepared from the seeds, which is used for inflammation of the kidneys. In Australia it is valued for pasture. In India the grain is sometimes used for food by the natives in times of scarcity. The Mobave Indians of California also use the grain for food, grinding it and making the flour into cakes or mush. (C. R. Orcutt.)



FIG. 35.—Crowfoot-grass (*Dactyloctenium aegyptium*).

stock except when young. It has a record of producing 10,209 pounds green and 3,518 pounds dry hay per acre. Johnson, in his work on British grasses, says of the tendency of Tufted Hair-grass to form tussocks: "In the economy of nature these tufts, so unsightly and disfiguring to the landscape, are valuable by contributing to elevate and solidify low lands liable to be overflowed by rivers, and where they occur on hill and mountain slopes, by binding the spongy soil and preventing the slips which would leave them bare." This grass is most abundant in the Rocky Mountain region, where it doubtless serves to a considerable extent the purpose here mentioned. In England it is sometimes used by the farmers to make door mats. In Germany it furnishes the "Lyme-grass" used in upholstery. Price of the seed in New York, \$22 per 100 pounds.

No. 85. *Deschampsia flexuosa* (L.) Trin. Wood-Hair grass. (Fig. 36.)

A slender perennial grass, 1 to 2 feet high, with numerous very fine root-leaves and a delicate capillary panicle. It grows in tufts like *Deschampsia cespitosa*, and is

No. 83. *Danthonia compressa* Austin. Tennessee Oat-grass.

A slender, erect, tufted perennial, usually growing to the height of about 2 feet, with long and narrow root-leaves, and few-flowered spreading panicles. It is a common grass in the hilly regions of New England and the Middle States, and extends southward into North Carolina and Tennessee along the mountains, where it forms the bulk of the forage of the so-called "balds" or parks which are common to mountains in the South. It is highly nutritious, as determined by chemical analysis, as well as by its effect upon the stock grazing upon it. It stands well the trampling and grazing of both horses and cattle, but sheep are too close feeders, and where these range it soon disappears.

No. 84. *Deschampsia cespitosa* (L.) Beauv. Tufted Hair-grass.

A native perennial, ranging from New England to Pennsylvania, and westward to the Pacific Coast. It yields an inferior, coarse, harsh forage, and is not eaten by

more common in the Eastern States than that species, but is even less valuable for meadows. It is, however, of some value for woodland pastures, as it will grow very well in the shade. It extends southward along the mountains into North Carolina and Tennessee. Its range westward is limited. It has a record of producing 12,209 pounds of rowen and 3,318 of dry hay per acre. The price of seed quoted in New York catalogues is \$15 per 100 pounds.

No. 86. *Distichlis spicata* (L.) Greene. Salt-grass. (Fig. 37.)

An upright, wiry grass, 10 to 20 inches high, with strong, extensively creeping root-stocks. Common along the coast on both sides of the continent, and abundant in the alkaline regions of the interior, where it is often found covering considerable areas to the exclusion of other grasses. It thrives even in ground heavily crusted with alkali and other salts sufficient to destroy almost any other kind

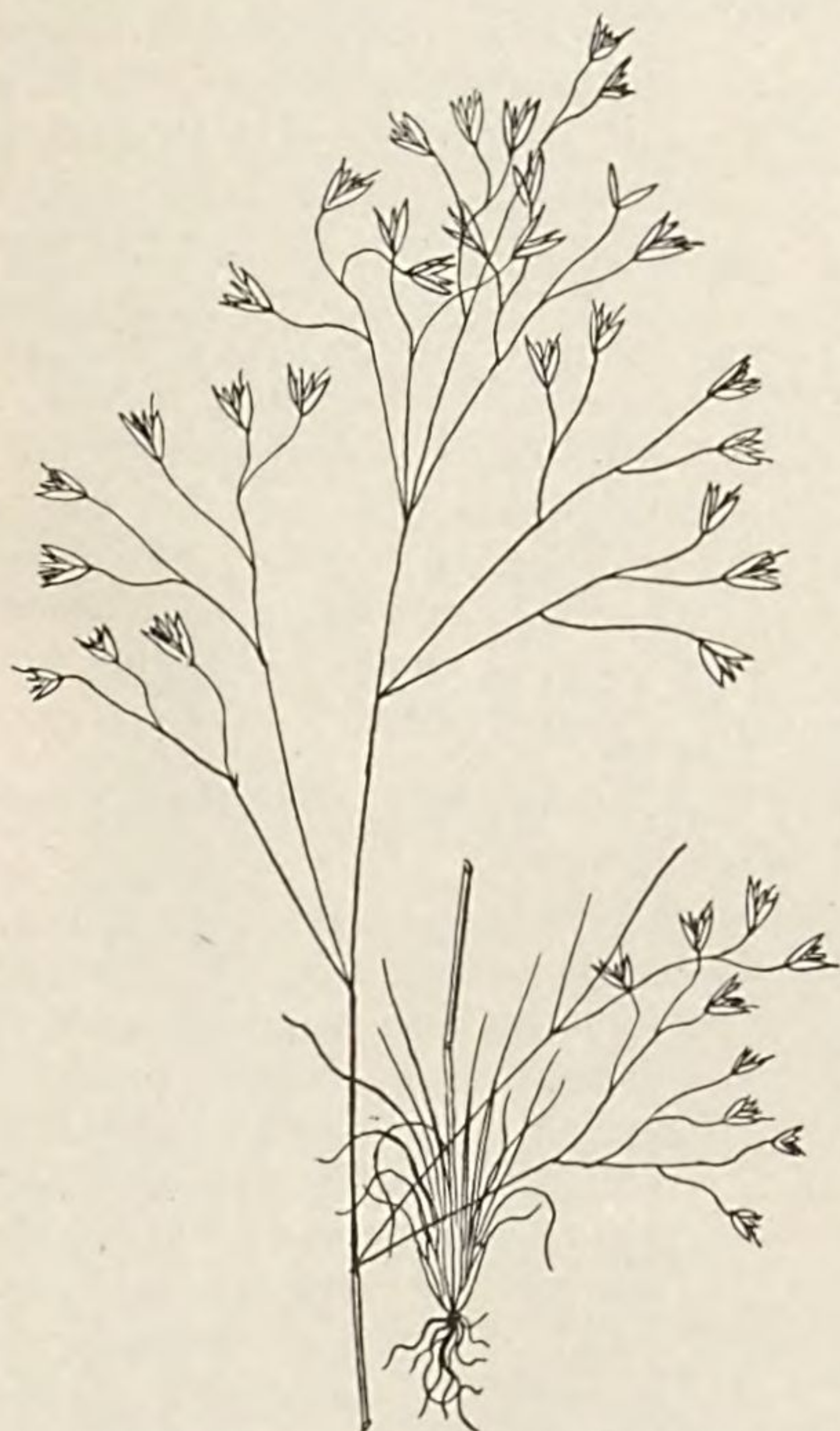


FIG. 36.—Wood Hair-grass (*Deschampsia flexuosa*).



FIG. 37.—Salt-grass (*Distichlis spicata*).

of vegetable growth. Prospectors and miners consider its presence a sure sign of water near the surface, and when crossing the desert select spots where it grows to dig for water (Orcutt). In farming lands it is deemed a nuisance, for its tough, matted roots make a sod almost impossible to break up with a plow. Although sometimes eaten by stock in the absence of better sorts, it has little agricultural value. It is a good grass for binding loose sands or soils subject to wash.

No. 87. *Eatonia obtusata* (Michx.) Gray. Early Bunch-grass.

A tufted perennial, 1 to 2 feet high, with flat leaves and rather densely flowered nodding panicles. This is a native species, growing usually in moist soil, and ranging from New York to California and southward. A tender grass, readily eaten by stock, which, when abundant, supplies considerable native forage of good quality.

No. 88. *Eleusine coracana* (L.) Gaertn. African Millet.

An erect annual grass, 2 to 4 feet high, closely related to and much resembling our common crowfoot (*Eleusine indica*), but of rather stouter habit and with larger spikes and seeds. It is cultivated in India, southern China, Japan, and in many parts of Africa for the grain, which is used as food. It forms the principal food of many African tribes. In spite of the bitter taste of the flour, a kind of bread or unleavened cake is made of it. Beer is brewed from the grain in Abyssinia. Said to yield good crops, even on very poor soil, and may be cultivated in the same way and for the same purposes as millet. The seeds are marked with very fine, comb-like lines.

No. 89. *Eleusine indica* (Linn.) Gaertn. Goose-grass. (Fig. 38.)

A coarse, tufted annual, with erect or spreading stems, 6 inches to 2 feet high; spikelets arranged in a number of spikes which are clustered at the top of the stem.



FIG. 38.—Goose-grass (*Eleusine indica*).

This grass is distributed throughout the warmer countries of the globe, and is particularly abundant in the Southern States, growing in cultivated grounds about dwellings, etc. It has somewhat wiry, flattened stems, many springing from a single root, and rather thick leaves. Some authors have spoken of it as being nutritious and good for grazing or soiling and for hay, but it is more generally regarded as a weed, and often a troublesome one in door-yards or lawns.

No. 90. *Elymus arenarius* Linn. Sea Lyme-grass. (Fig. 39.)

A stout, coarse grass, 2 to 8 feet high, with strong, creeping rootstocks, smooth stems, long, rigid leaves, and dense terminal spikes 6 to 12 inches long. The spikelets are about an inch long and three- to four-flowered. This grass is common along the sea-coast of northern Europe, our north Atlantic coast, and on our Western shores from Santa Cruz, Cal., northward to within the Arctic zone. It is one of the best grasses known for binding the drifting sands of the

coast, and in northern Europe has been cultivated along with Beach-grass for this purpose. These two grasses when combined seem admirably adapted for the purpose of forming a barrier to the encroachment of the sea; the sand that Beach-grass arrests and collects about itself the Lyme-grass secures and holds fast. The seeds are used for food by the Digger Indians of the Northwest, and as the grass springs up around their deserted lodges it is called by the settlers "*Rancheria*" grass. This Lyme-grass is usually regarded as possessing little or no forage value, but in very moist climates or under certain favorable conditions it may yield a valuable fodder, for when young the grass is tender and nutritious.

No. 91. *Elymus canadensis* Linn. Wild Rye.

A rather stout, smooth perennial, 3 to 5 feet high, with broad, flat leaves, 6 to 12 inches long. The bearded spikelets are arranged in a terminal spike or "head," which has some resemblance to a head of rye. Common in low thickets and

along streams in rich, open woods throughout the country. In the Northwest it is regarded as of some agricultural value; its cultivation is evidently worthy of trial, for if it could be successfully grown its yield of hay would be large, and, judging from appearances, the hay would be of good quality.

No. 92. *Elymus condensatus* Presl. Giant Rye-grass.

The largest of the native Rye-grasses, growing to the height of 5 to 10 feet. Common in the Rocky Mountain regions and on the Pacific slope, usually growing along rivers or streams the banks of which are protected and held together by the strong, spreading rootstocks of the grass. This grass is useful for holding the sand on railway banks, etc. When young this grass makes excellent hay, and when allowed to stand it affords a considerable amount of fodder for stock on the winter ranges. The seeds are used for food by the Indians.

No. 93. *Elymus macounii* Vasey. Macoun's Rye-grass.

A perennial grass, found quite abundantly in moist meadows, in the gravelly foothills of the northern Rocky Mountains. The culms are leafy, and this grass contributes quite largely to the native hay cut by the ranchers of the Northwest. It is apparently a very valuable species.

No. 94. *Elymus mollis* Trin. Soft Sea Lyme-grass.

A grass which closely resembles and has the same habit of growth as *Elymus arenarius*. It is distinguished by having the stem soft-downy just below the head or spike and in having five to seven flowered spikelets, the outer glumes of which are broader and five- to seven-nerved. This grass occurs along the shores of the Great Lakes and northward on both the Atlantic and Pacific coasts.

No. 95. *Elymus triticoides* Nutt. Wild Wheat.

By some this has been regarded as a small, reduced form of *Elymus condensatus*, mentioned above. It grows to the height of 2 to 3 or 4 feet and is native of the Rocky Mountain region and Pacific Slope, extending eastward nearly to the Mississippi. While it is a grass of good appearance and possibly of some agricultural value, no attempts have been made to cultivate it.

No. 96. *Elymus virginicus* Linn. Terrell-grass. (Fig. 40.)

The most common of our native species of Lyme-grass, growing along streams, the borders of woods and thickets, more rarely in the open ground. It is an erect, smooth grass, 2 to 3 feet high, with rigid terminal spikes, which are often partly included within the upper leaf-sheath. This grass has the appearance of possessing some agricultural value; it forms an inferior turf, and by the time it blooms all the lower leaves are usually dead.

When young it doubtless possesses some value as a native pasture grass. In Kansas, South Dakota, and Nebraska it is regarded a valuable grass for woodland pastures.



FIG. 40. — Terrell-grass (*Elymus virginicus*).

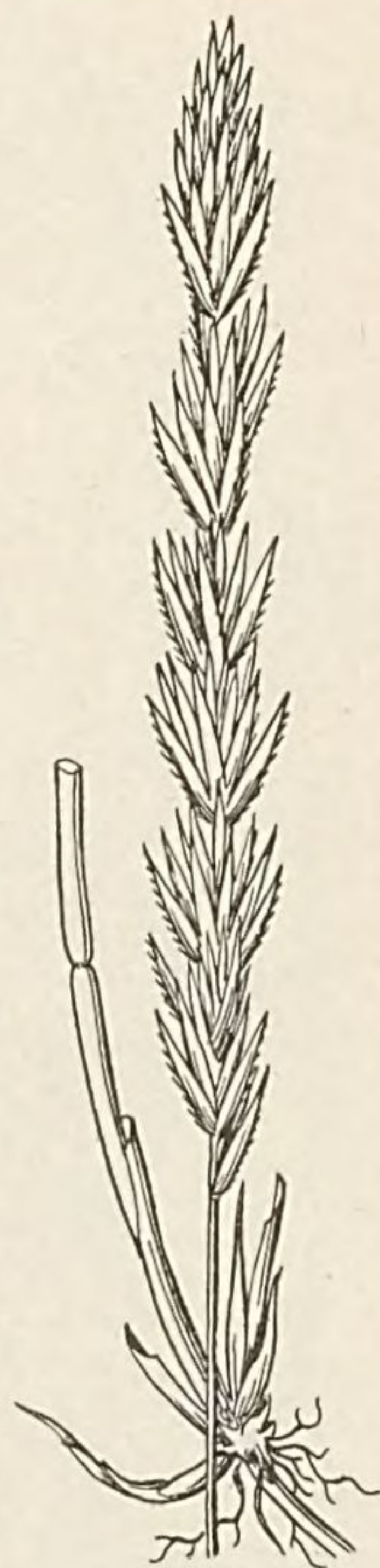


FIG. 39.—Sea Lyme-grass (*Elymus arenarius*).

No. 97. *Epicampes rigens* Benth. Deer-grass. (Fig. 41.)

A stout, erect grass, 3 to 4 feet high, with rigid, wiry stems, and a very long, narrow, densely flowered, spike-like panicle. This grass is not uncommon in Arizona, southern California, and New Mexico, growing in sandy soil. It is regarded as one of the best native dry-land grasses, and is closely grazed wherever stock can get at it. The roots of *Epicampes macroura* — Mexican Broom-root or Mexican Whisk—are used in making brushes and are exported from Vera Cruz to Europe for this purpose.



FIG. 41.—Deer-grass (*Epicampes rigens*).

rains, particularly in the region about Deming, where it is called “Crab-grass.” It is an annual, growing to the height of 2 to 4 feet, with widely spreading, many flowered panicles, and is largely cut for hay.

No. 99. *Eragrostis major* Host. Stink-grass. (Fig. 42.)

A rather showy, much-branched annual, with erect or ascending stems, 6 inches to 2 or 3 feet high. This species, which is a native of Europe, has become widely distributed in this country, growing chiefly in cultivated or waste grounds, especially in light soils. When fresh it emits a strong, unpleasant odor.



FIG. 42.—Stink-grass (*Eragrostis major*).

No. 100. *Eragrostis obtusiflora* (Fourn.) Scribn. Mexican Salt-grass.

A rigid perennial, 12 to 18 inches high, with strong and extensively scaly rootstocks, stiff and sharp-pointed leaves, and more or less spreading panicles. Abundant in the highly alkaline soils of Sulphur Springs Valley, Arizona, where the large rootstocks serve to bind the shifting sands. In the absence of other grasses it is eaten by stock.

No. 101. *Eragrostis pilosa* (Linn.) Beauv. Slender Meadow-grass.

A slender branching annual, 6 to 18 inches high, with narrow, flat leaves and capil-

lary, open panicles. This grass is widely distributed throughout the subtropical and warmer temperate regions of both hemispheres. In this country it has received no attention or is regarded as little more than a weed, but in Australia and India it is spoken of as being an excellent fodder grass, and the seeds are eaten by the natives of Ajmere, India.

No. 102. *Eragrostis purshii* Schrad. Southern Spear-grass.

A native annual, similar in appearance to *Eragrostis pilosa*, and growing in similar situations. It is common from the Middle States southward, and extends southwestward into Texas and Arizona, where it exists in a great variety of forms. It grows to the height of 1 to 2 feet. It is nowhere considered of any agricultural importance.

No. 103. *Erianthus ravennæ* Beauv. Plume-grass.

A stout grass growing to the height of 8 or 10 feet, with large and plume-like panicles 10 to 20 inches long, resembling in some degree Pampas-grass. Cultivated for lawn decoration, as is also the variety with variegated leaves. A native of the Mediterranean region.

No. 104. *Erianthus saccharoides* Michx. Plume-grass.

A tall stout grass of striking appearance, 4 to 6 feet high, with a reddish or silvery-white showy panicle from 5 to 10 inches long. This grass ranges from New Jersey to Illinois and southward to the Gulf, growing in very wet places and open swamps. Of no agricultural value, but deserves notice as an ornamental grass for lawns and gardens.

No. 105. *Eriochloa aristata* Vasey. Mexican Everlasting-grass.

A branching leafy annual, 2 to 3 feet high; native of Mexico. Seed of this grass was obtained by the Department in 1888. It was cultivated in the grass garden located at Starkville, Miss., by Prof. S. M. Tracy, who says that it is a much more promising grass than *E. annulata*, more hardy, less injured by drought, and produces a heavier growth. It will make two good crops of hay annually in the South, the best crop being from the second growth, which is ready to cut in October. The grass produces an abundance of seed and reseeds itself, making its production comparatively inexpensive.

No. 106. *Eriochloa punctata* (Linn.) Hamilt. Everlasting-grass.

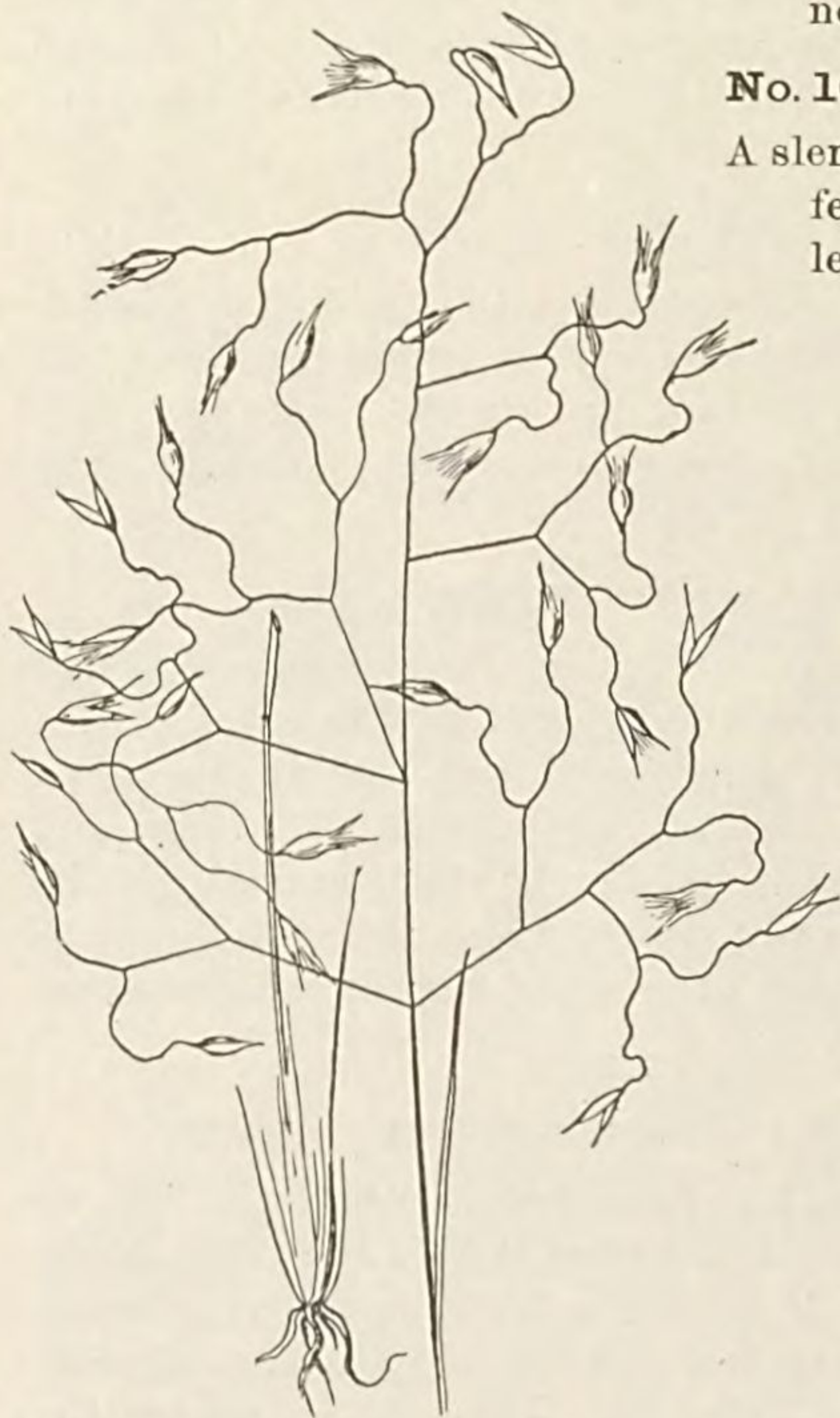
A quick-growing, smooth, succulent perennial, 2 to 3 feet high, with flat leaves and narrow panicles 2 to 4 inches long. Widely distributed within the tropical and subtropical regions of both hemispheres. In Australia it is regarded as an excellent pasture grass, lasting all the year round and well liked by stock. The seed, which is produced abundantly, is easily gathered. This grass deserves the attention of Southern dairymen. In Arizona it grows throughout the valleys in irrigated soil, or in the rich moist places of the plains, yielding abundant herbage eagerly sought by all kinds of stock.

No. 107. *Eriocoma cuspidata* Nutt. Indian Millet. (Fig. 43.)

A grass of rather striking appearance, 1 to 2 feet high, widely distributed throughout the Rocky Mountain region from British America southward to Texas and New Mexico, eastward to the Missouri, and westward to the Sierras of California. It grows in dry sandy soils, forming bunches of greater or less size, and from this habit of growth it has been called, along with a number of other grasses, "Bunch-grass." It thrives in soil too dry and sandy for the growth of most other grasses, and is much esteemed for grazing in the regions where it abounds. In New Mexico this grass is by some deemed superior to grama, on account of its large and nutritious seeds or grains, which are used by the Indians to some extent for food.

No. 108. *Euchlaena mexicana* Schrad. Teosinte. (Fig. 44.)

A stout, leafy, annual grass, 8 to 10 or 12 feet high, resembling Indian corn, to which it is botanically closely related. The variety *E. luxurians*, of the seed catalogues, which has been cultivated in various parts of the South and West, has a habit of tillering, or sending up many—20 to 50—stalks from the same root (Plate III, fig. 1). From this habit the bulk of fodder produced to the acre is very large, probably unequaled by any other grass. It is liked by all kinds of stock, and has especial value as a green fodder when other forage is dried up. It may be cut several times during the season, but nearly as good results will be obtained from a single cutting, made before there is any frost. The stalks are tender, and there is no waste in the fodder when dry or green. One pound of seed to the acre, planted in drills 3 feet apart and thinned to a foot apart in the drill, is recommended. It is a native of the warmer portions of Mexico and Central America. The seed rarely matures north of southern Florida.

FIG. 43.—Indian Millet (*Eriocoma cuspidata*).**No. 109. *Festuca duriuscula* Lam. Hard Fescue.**

A slender, densely tufted, perennial grass, 1 to 2 feet high, with numerous very fine radical leaves and open panicles. This is one of the

FIG. 44.—Teosinte (*Euchlaena mexicana*).

forms of Sheep's Fescue, and is of little value except in pastures. Its particular merit lies in its ability to thrive on dry sandy soils unfit for the growth of better grasses, and it well resists long periods of summer drought. It is well adapted to the cooler and mountainous regions of our country, being a native of the cooler temperate regions of both hemispheres. On well-manured, clayey land this Fescue has produced upon a single acre 18,376 pounds of green hay at time of flowering, and 8,269 pounds of hay besides 10,029 pounds of aftermath. It possesses some value as a lawn grass, but if used for this purpose it should be sown thickly and unmixed with other sorts. Sow $2\frac{1}{2}$ to 3 bushels to the acre. Price of seed in New York market, \$16 to \$18 per 100 pounds.

No. 110. *Festuca elatior* Linn. Tall, or Meadow Fescue.

This grass has been widely cultivated in this country, having been introduced from Europe, and has become thoroughly naturalized. It is an exceedingly valuable



FIG. 1.—YOUNG PLANTS OF TEOSINTE IN GRASS GARDEN OF THE U. S. DEPARTMENT OF AGRICULTURE.

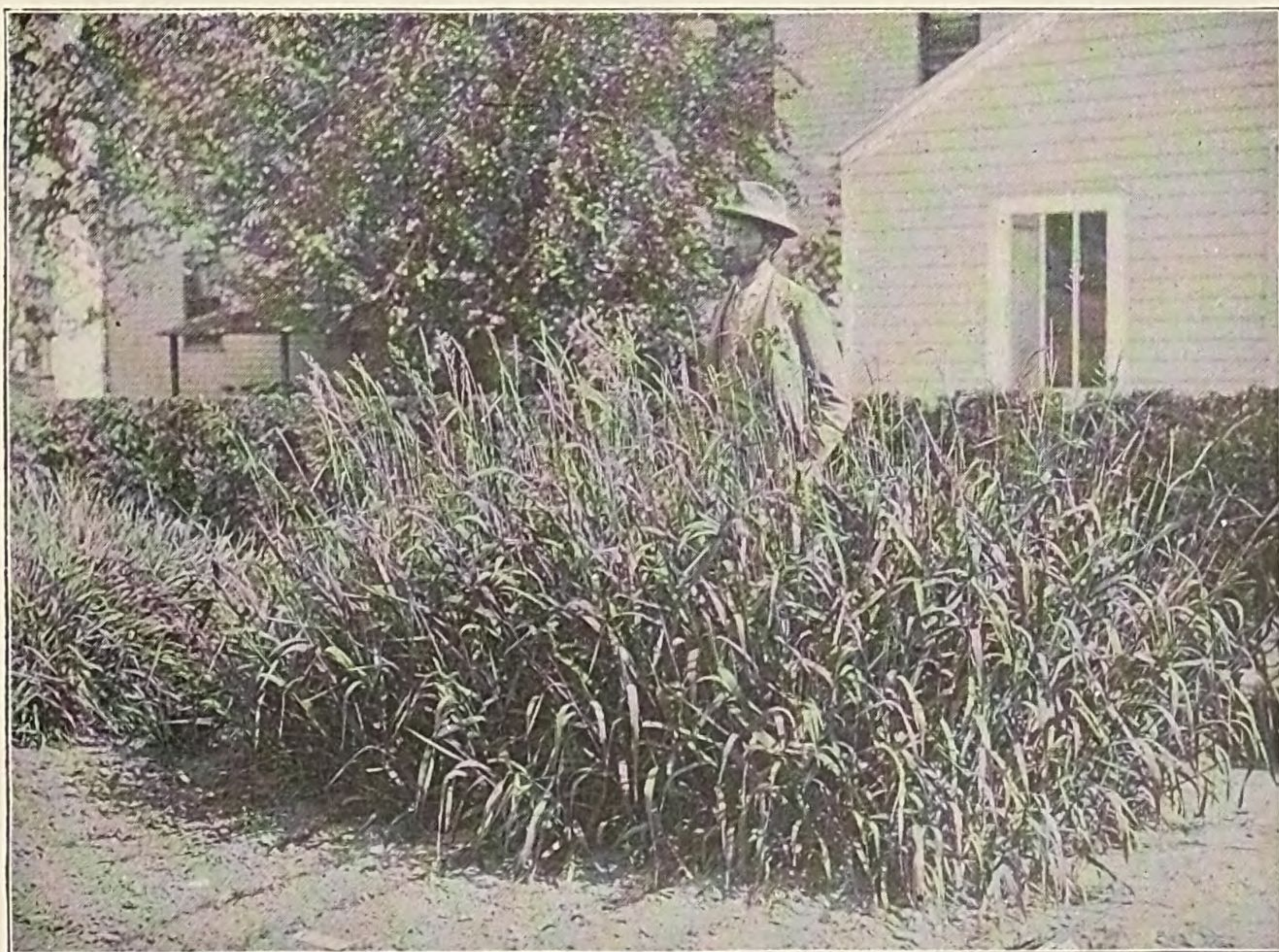


FIG. 2.—REED CANARY GRASS IN GRASS GARDEN OF THE U. S. DEPARTMENT OF AGRICULTURE.

grass either for mowing or pasture. It is productive on soils which are not too dry, and, being of long duration, is especially valuable for permanent pastures. It thrives best on moist soils rich in humus, whether marls or clays. The variety *pratensis*, or Meadow Fescue, is a common form, rather smaller than the species, with a narrower and fewer-flowered panicle. Variety *arundinacea*, or Reed Fescue (fig. 45), is a very vigorous, tall form, 3 to 4 feet high, exceedingly hardy, and yields a very large amount of hay of excellent quality, succeeding best on lands that are comparatively moist. The seed of Meadow Fescue is quoted in some of the New York catalogues at \$3.50 per bushel or \$22 per 100 pounds. A bushel weighs about 14 pounds.

No. 111. *Festuca heterophylla* Lam. Various-leaved Fescue.

A rather slender European grass, 2 to 4 feet high, with very narrow (setaceous) root-leaves, and narrow but flat culm leaves. It is a perennial, closely related to Creeping Fescue, of which it has been made a variety by some authors. The panicle is comparatively large, open and nodding at the apex. It is a species preferring a rather mild climate, and grows naturally in open woodlands or along their borders. It makes its best growth on low-lying lands which are not too dry, but upon good soil it withstands protracted periods of drought very well. Owing to the great production of fine root leaves, this species makes a good bottom grass, and as these leaves are quite soft the grass is well adapted for lawns, and is particularly recommended for those which are too much shaded for the successful growth of other lawn grasses. It is an excellent grass, also, for woodland parks where the soil is not sandy. European authorities have classed it with the best forage plants. It is little known in this country, but the seed is offered for sale by our leading seedsmen, the retail price being from \$2.75 to \$3 per bushel of about 14 pounds.

No. 112. *Festuca kingii* (S. Wats.) Scribn. King's Fescue.

A tall dioecious bunch grass, common in the foothills and canyons of Colorado and Montana. It is a very robust species, and supplies a large amount of good though coarse winter forage. Growing naturally at an elevation of 7,000 to 8,000 feet, it might prove valuable in cultivation in similar localities.

No. 113. *Festuca ovina* Linn. Sheep's Fescue.

Sheep's Fescue exists in many varieties in the Northwestern States, especially in the Rocky Mountain region. Some of these varieties attain the height of 2 or 3 feet, but for the most part they are rarely more than a foot high, producing a large amount of fine herbage, which is valuable for grazing, especially for sheep. Some of the native varieties are well worthy the attention of the agriculturist. All the forms of *Festuca ovina* are "bunch-grasses," and are devoid of the creeping roots, the presence of which distinguishes the Red Fescue (*Festuca rubra*) from this species. Sheep's Fescue is well adapted for cultivation on light, dry soils, especially those which are shallow and silicious. Although a native of this country, our seed supply comes mostly, if not entirely, from Europe, where



FIG. 45.—Reed Fescue (*Festuca elatior arundinacea*).

the grass is also native. Sow $2\frac{1}{2}$ to 3 bushels per acre. The weight of a bushel of seed is about 14 pounds. Price per bushel, \$2.25 to \$2.75 in New York.

No. 114. *Festuca rubra* Linn. Red Fescue.

This grass grows along the Atlantic coast of the New England and Middle States, and in the Northern States, extending westward to the Pacific. Like *Festuca ovina*, it presents many forms, but in some respects is superior to that species, as by its creeping rhizomes it will form a compact and durable turf. On account of this habit of growth, it is a useful grass for binding moving sands along the seacoast, or covering gravelly banks and dry slopes. In Germany, Red Fescue is regarded as one of the most valuable grasses for dry, sandy meadows. Owing to the great production of fine root leaves, this species makes a good bottom grass, and as these leaves are quite soft the grass is well adapted for lawns, and is particularly recommended for those which are too much shaded for the successful growth of other lawn grasses. It is an excellent grass also for woodland parks where the soil is not sandy. European authorities have classed it with the best forage plants. It is little known in this country, but the seed is offered for sale by our leading seedsmen, the retail price being from \$2.50 to \$3 per bushel of about 14 pounds. A variety, *F. rubra glaucescens* Hack. (fig. 46), is the best pasture grass in the mountain meadows of North Carolina and East Tennessee.



FIG. 46.—Tennessee Fescue (*Festuca rubra glaucescens*).

No. 115. *Festuca scabrella* Torr. Great Bunch-grass. (Fig. 47.)

A strong perennial, growing in large tufts or bunches 1 to 3 or 4 feet high. A native of the Rocky Mountain regions, extending from Colorado northward and westward to California and Oregon. It often occupies extensive mountain parks, to the ex-

clusion of other grasses, where it affords excellent grazing. It may be cut for hay, of which it furnishes a large amount, excellent in quality, especially for horses. It is one of the best grasses for winter stock ranges. In the Northwest, particularly in the Rocky Mountain region, there are many native species of the genus *Festuca* which are well deserving the attention of stockmen and farmers.

No. 116. *Festuca tenuifolia* Sibth. Slender Fescue.

A low and fine-leaved grass, in habit of growth resembling *Festuca ovina*, of which it is regarded as only a variety by most authors. It has no special agricultural value, but will grow in dry and comparatively sterile soil. Its fine, hair-like leaves and densely cespitose habit of growth render it a good lawn grass when properly treated, especially for shady places, and it is also a good plant for edgings.

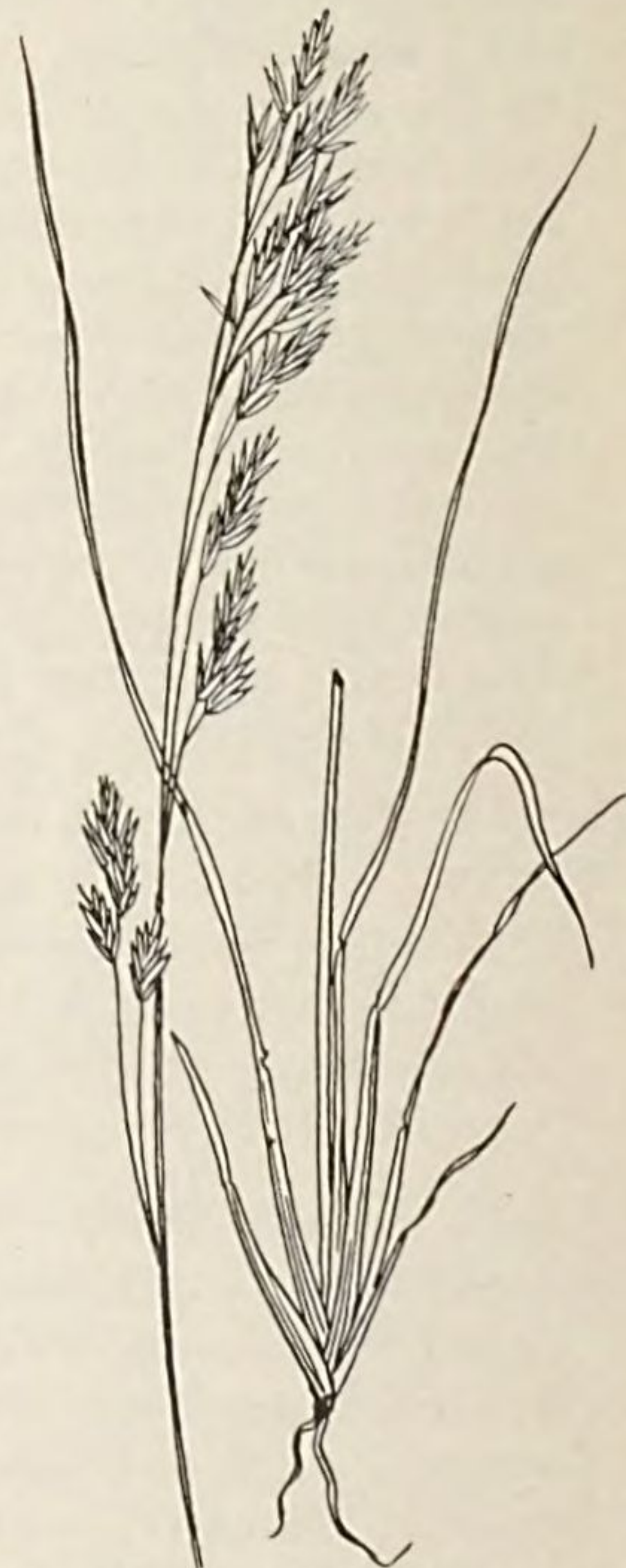


FIG. 47.—Great Bunch-grass (*Festuca scabrella*).

No. 117. *Fourniera mexicana* Scribn. Mexican Lawn-grass.

A low, extensively creeping grass that grows in the mountain valleys of western Mexico. Stock eat it with avidity. An excellent lawn and pasture grass for subtropical regions.

No. 118. *Gynerium argenteum* Nees. Pampas-grass.

A stout perennial, 8 to 12 feet high, with mostly radical, narrow leaves 3 to 6 feet long, and showy, silvery white or rose-red panicles 15 to 30 inches long. A much-prized ornamental for lawn decoration. The handsome panicles are used for dry bouquets. Growing Pampas plumes is an important industry in some parts of California. These plumes or panicles are cut when exposed only a few inches from the leaf sheath, then dried, and done up into bundles for shipment. Pampas-grass is a native of southern Brazil and Argentina, and there the long leaves are used for paper making, and a decoction of the rhizome is used as a diuretic. *G. roseum* is a horticultural variety, with pale, rose-colored plumes. *G. variegatum* is a form with variegated leaves.

No. 119. *Hilaria cenchroides* HBK. Curly Mesquit. (Fig. 48.)

A delicate perennial with slender, creeping stems, the upright, leafy shoots a few inches to nearly a foot high. This is one of the most valuable of the grasses of the dry plains and mesas of the Southwest. It forms a dense, green sward, and in habit of growth closely resembles the true Buffalo-grass. It has the habit of creeping over the ground and rooting at the joints of the stems, from which spring leafy branches that in turn reach out for other places in which to take root. It makes a thick mat of leafy turf during the summer, matures on its roots, and in the fall and winter, when not rotted by late rains, affords excellent pasturage for all classes of stock. No grass stands the long dry spells to which the Southwest is periodically subject better than the Curly Mesquit. At such times it dries up and appears dead, but in a few hours after a warm rain it becomes green to the end of the smallest branches. It is best propagated by transplanting the runners. Seed is produced in abundance, but is both difficult to harvest and of rather uncertain vitality.



FIG. 48.—Curly Mesquit (*Hilaria cenchroides*); a, group of spikelets; b, spikelet; c, d, florets.

No. 120. *Hilaria mutica* Benth. Black Bunch-grass.

This is a rather coarse perennial, with creeping rootstocks, and stems 12 to 18 inches high. It is common on the dry mesas of New Mexico and Arizona, extending eastward into Texas and Indian Territory. Where abundant it is regarded as one of the most valuable native grasses and furnishes excellent pasturage at all

times when not covered with snow, and is frequently cut for hay. It forms dense patches of greater or less extent on hillsides, mesas, and plains. It is also called "Black grama," and is largely gathered for hay, being uprooted with a hoe. (Pringle.)

No. 121. *Hilaria rigida* (Thurb.) Scribn. Galleta. (Fig. 49.)



FIG. 49.—Galleta (*Hilaria rigida*).

In the driest regions of southern California and Arizona, growing in the deserts where other grasses are rarely seen. It has coarse, much-branched, and woody stems, 2 feet high or more, growing in great clumps, resembling in its habit some of the dwarf bamboos. The stems and leaf sheaths are clothed with a dense, white-matted pubescence, which gives to the grass a peculiarly striking appearance. In the regions where it grows it is regarded as valuable forage for pack animals and mules, there being little other vegetation which they can eat. Without this grass miners and prospectors would find great difficulty in traversing the arid mountain and desert regions of the Southwest, since scarcely any other forage plants occur in the districts occupied by it (Orcutt). The *Hilarias*, of which we have four species, are grasses peculiarly adapted for growth in the drier lands of the Southwest, and although they are, with the exception of *Hilaria cenchroides*, wiry and tough, the forage they afford is very acceptable in the absence of more succulent plants.

No. 122. *Holcus lanatus* Linn. Velvet-grass. (Fig. 50.)

A perennial, 1 to 2 feet high, with a creeping rootstock, and stems and leaves clothed all over with a soft, whitish pubescence. This grass has been introduced into this country from Europe, and has become naturalized in many places. It possesses little nutritive value, and is not well liked by stock, particularly horses. It possesses some value, however, on peaty or sandy soils where the better grasses will not grow. Its cultivation, however, is not recommended. It is entirely unsuited for lawns.



FIG. 50.—Velvet-grass (*Holcus lanatus*).

No. 123. *Holcus mollis* Linn. Creeping Soft-grass.

Closely allied to Velvet-grass, and said to be similarly well adapted to light, sandy forest lands. It is occasionally found in the Eastern States, the seed having been introduced with that of other grasses from Europe, as both *Holcus mollis* and *Holcus lanatus* are often used to adulterate the seeds of more expensive grasses, especially the so-called prepared mixtures

of seedsmen. In Germany this grass is used on railway embankments, where on the poor, thin soil its strong, creeping roots form a turf which holds the earth together, thus preventing it from being washed or blown away.

No. 124. *Hordeum jubatum* Linn. Squirrel-tail-grass. (Fig. 51.)

A rather slender annual or biennial, usually about a foot high, growing along the sandy seashore, borders of the Great Lakes, and in the alkaline regions of the West. The long, slender awns of the glumes are widely spreading, and the head or spike is thus given the appearance of the "brush" of the fox, hence the common name, "foxtail." This grass is sometimes recommended for cultivation for ornament, and if the tops are cut off before the awns have expanded they may be used for dry bouquets; but the heads soon break up, and for this reason the grass is of little value even for ornament. It has no agricultural value, and, in fact, where it has spread in the West, as it often does along the irrigating ditches, it becomes a serious pest. Hay containing this squirrel-grass is considered nearly valueless. The sharp-pointed joints of the spike, each with several long and slender beards, stick fast in the nose and mouth of horses and cattle, often penetrating the flesh, and cases are reported where they have caused the death of these animals.

No. 125. *Hordeum murinum* Linn. Wall Barley.

A coarse, tufted annual, 6 inches to 2 feet high, with dense and somewhat flattened, bearded spikes 2 to 4 inches long. The beards or barbed awns are 1 to 1½ inches long and rather rigid. This grass is a native of Europe, and has been introduced along the Pacific Coast, particularly in California, where it has become a serious pest. At maturity the head or spike readily breaks up, and the groups of spikelets, which are sharp pointed at the base, adhere to almost any passing object; they work up the nostrils of cattle and into the fleece of sheep, and may do injury to the animals in much the same way as the native *Hordeum jubatum*.

No. 126. *Hordeum sativum* Jessen. Barley.

Cultivated barley presents many varieties, primarily divided into two-rowed, four-rowed, and six-rowed races. The varieties under these races are based upon the varied characters presented by the head, beards, or grain. All appear to have originated from *Hordeum spontaneum* Koch, which grows wild in the countries of southwestern Asia. Six-rowed barley has been in cultivation since prehistoric times in southern Europe; two-rowed barley is now largely cultivated in England and central Europe. The four-rowed barleys are of later origin than the others, and are most generally cultivated in northern Europe and in this country. The barley crop of the United States for 1895 was 87,072,744 bushels, of which amount six States produced over 73,000,000 bushels, California leading with 19,023,678 bushels. Barley is the most important cereal of the far north, some of the varieties being cultivated in Norway to latitude 70°. It is employed in making bread also in northern Asia and Japan. Barley soup is an article of diet in central Europe. From naked barley (*Hordeum decorticans*) a

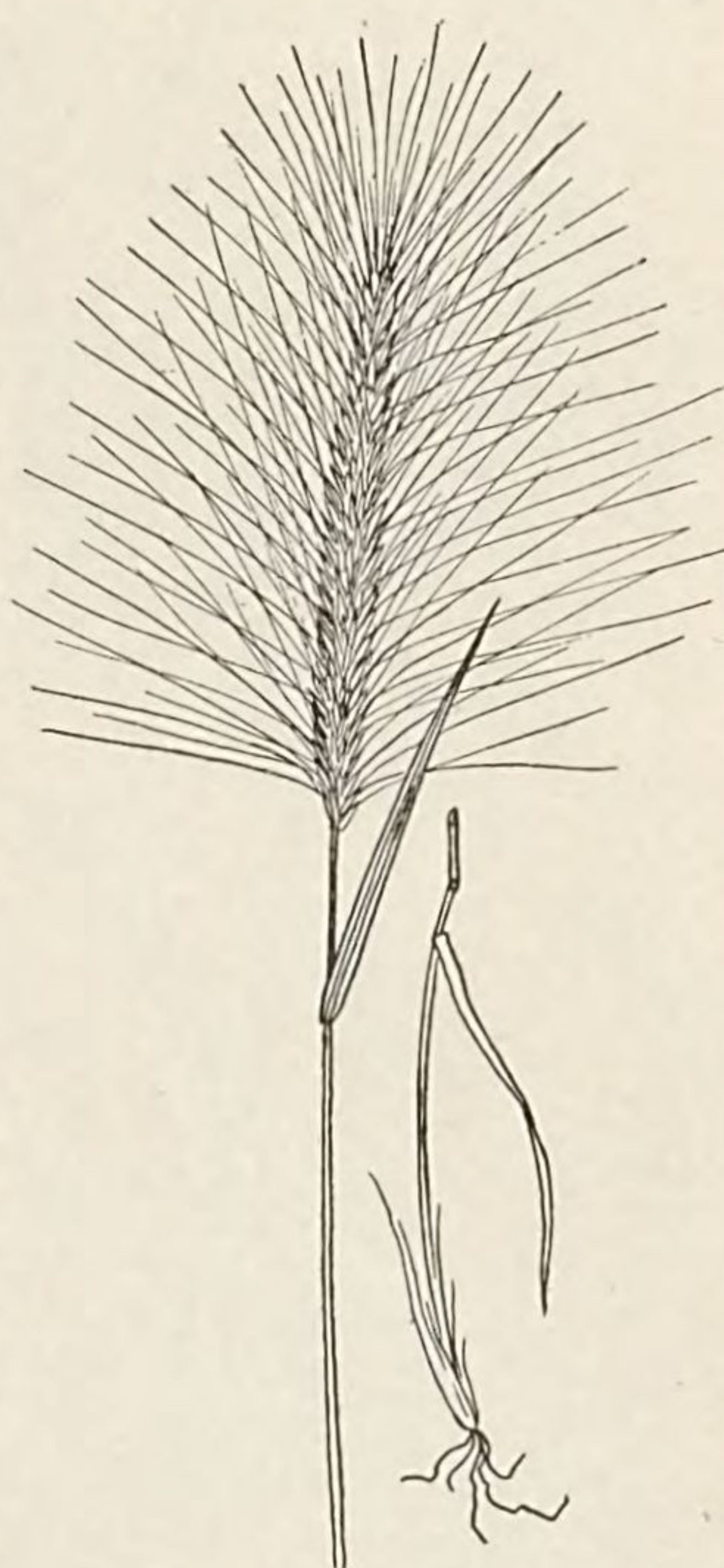


FIG. 51.—Squirrel-tail-grass (*Hordeum jubatum*).

mucilaginous tea is prepared, used in medicine. The grain is largely fed to horses, both in this country and in Europe, but the chief use is for brewing beer. "Brewers grains," a by-product, both wet and dry, are fed to cattle, chiefly in the vicinity of breweries.

No. 127. *Hydrochloa carolinensis* Beauv. Floating-grass.

A slender aquatic grass of the Gulf States, growing along muddy banks and in shallow streams. The stems are often 2 feet or more in length, and in shallow water their summits appear above the surface, while in water of greater depth

the uppermost leaves are floating. The tender stems and leaves are eaten by stock, and may afford some food for water-fowl.

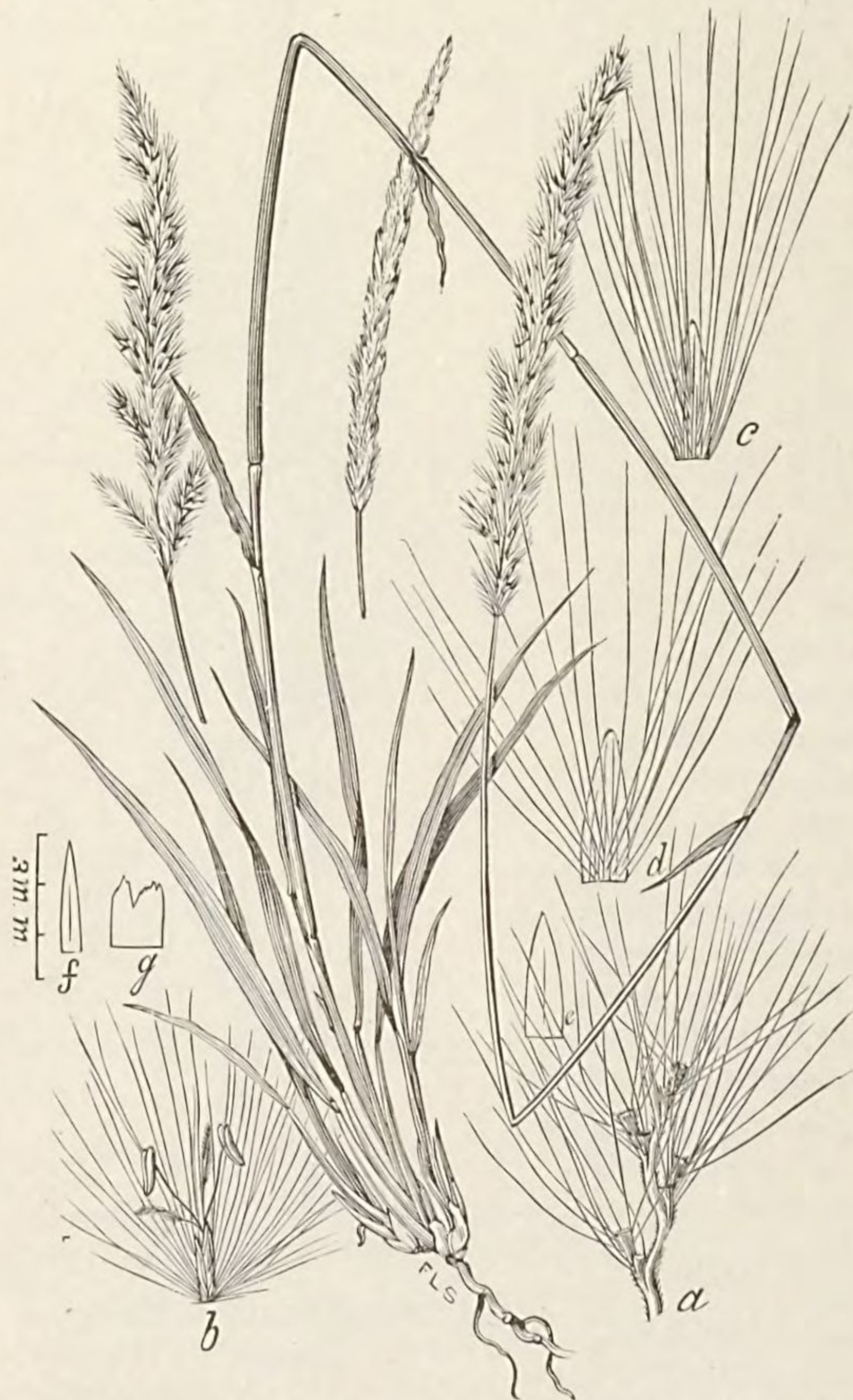


FIG. 52.—*Imperata hookeri*; a to g, details of spikelet.

ing roofs. Cattle eat it when young with apparent relish, and in Bengal it forms a very large portion of the pasturage. The Telingas make use of it in their marriage ceremonies. In western Texas and Arizona there is a native species, *Imperata hookeri* (fig. 52), very much like the one above described, in appearance and habit of growth. It grows naturally around the borders of alkaline springs.

No. 129. *Isachne australis* R. Br. Swamp Millet.

A slender grass, creeping at the base, the upright stems 1 to 2 feet high, with loose, open panicles of very small spikelets. It is a native of southern Asia and Australia, generally found growing along the sides of streams and on swampy ground. It is said to be liked by cattle, and Mr. Fred Turner recommends it

No. 128. *Imperata arundinacea* Cyrill. Blady-grass.

A sand and soil binder common throughout the warmer temperate and tropical regions of both hemispheres. It is a stout, erect, leafy grass, 1 to 3 feet high, with silvery-white spike-like panicles. The rootstocks form a perfect network of strong fibers, and in warm countries the grass is recommended for binding river banks, the sides of dams, and the loose sands of the coast. This grass is easily propagated by root cuttings, and might be utilized along the Gulf Coast or along the Lower Mississippi in strengthening the levees. In the Malay Archipelago this *Imperata* is the principal grass of the Alang Alang fields, and is used by the natives for thatch-

for planting on the banks of rivers or dams to protect them from injury by heavy rains or floods. The underground stems and roots quickly form a perfect mat in the soil, and when once established they make a very firm turf. The grass may be propagated by seeds or pieces of the root.

No. 130. *Koeleria cristata* (Linn.) Pers. Prairie June-grass.

This is a common grass upon the open meadows and plains of the Central and Western States, and extends beyond the Rocky Mountains to the Pacific Coast. It is one of the "bunch-grasses" of the plains region, where it is generally associated with the more common Bunch-grass, *Poa buckleyana*. On the dry bench lands it is seldom over a foot high, but in irrigated ground grows to the height of 2 feet or more, and makes excellent hay. Its cultivation is not to be recommended where better grasses may be had. However, it possesses some value for furnishing early forage, and might be used in reseeding the native pastures.

No. 131. *Lamarckia aurea* Moench. Golden-top.

A low annual, 3 to 12 inches high, with flat leaves and elegant one-sided panicles 2 to 3 inches long. This very attractive and favorite ornamental grass is a native of southern Europe and southwestern Asia. It is frequently cultivated in gardens, and is a pleasing grass for edgings. It has escaped from cultivation in southern California, and has become apparently spontaneous there.

No. 132. *Lolium italicum* A. Br. Italian Rye-grass. (Fig. 53.)

A well-known and excellent grass for rich and rather moist lands, particularly for the Eastern States. It is a very rapid grower, forms a dense turf, and in Europe, whence the grass was introduced into this country, it is regarded as one of the best hay grasses. On stiff, heavy clays or on very dry soil it does not do well; but on good, calcareous loams or marls, or on moist, loamy sands, where the soil is in good condition, it is very productive, and no other grass repays manuring so well. It is not recommended for permanent pastures, as its duration is only two or three years, but it is a most excellent species for temporary meadows. Few grasses develop more rapidly than this, and where the soil is rich and its fertility maintained by applications of liquid manure, cuttings may be obtained within three or four weeks from seeding, and at intervals of a month or six weeks successive crops may be harvested. Owing to its succulent character and rapid growth, this makes one of the best grasses for soiling. Italian Rye-grass is at



FIG. 53.—Italian Rye-grass (*Lolium italicum*): a, spikelet; b, c, florets; d, e, caryopsis.

once distinguished from any of the forms of perennial Rye-grass by its awned or bearded spikelets. Adulterations of the seed of Italian Rye-grass are rare, owing to its relative cheapness. The average purity of commercial seed is 95 per cent, while the germinative power is 70 per cent. The germinative power diminishes rapidly with the age of the seed. One pound of seed contains on an average 285,000 grains, and the weight per bushel varies, according to the quality, from 16 to 24 pounds. Three bushels of seed of average quality are required for sowing an acre of land. The current price in the New York market is \$10 per 100 pounds.

No. 133. *Lolium perenne* Linn. Perennial Rye-grass.

Perennial Rye-grass has been cultivated in England for more than 200 years, and is therefore one of the oldest if not the very first grass gathered and cultivated



FIG. 54. — Perennial Rye-grass
(*Lolium perenne*).

separately for agricultural purposes. It is indigenous to Europe, North Africa, and western Asia, and was many years ago introduced into this country from England. Here it has never been so highly esteemed as in England, where the soil and climate appear to be especially well adapted to its growth. Moist and rich loams or clays are the soils best suited to it, as with Italian Rye-grass, it responds promptly to the application of quick manures. For pastures on heavy soils in moist climates it is especially valuable, and under such conditions is largely used in mixtures for permanent pastures. It is a good hay grass where the conditions are favorable, but in this country will never be so highly esteemed as Timothy. There are several varieties of perennial Rye-grass recognized by agriculturists. Pacey's Perennial, a vigorous form, is one of these. The average purity of perennial Rye-grass seed is given at 95 per cent, and the germinative power at 75 per cent. Good commercial seed should grade higher than this. One pound of pure seed contains on an average 336,800 grains. Of course, where the seeds are larger and heavier, this number would be considerably less. The best seed weighs from 25 to 35 pounds per bushel, and 2 to 3 bushels of seed are required per acre. The current retail price of good seed is \$8 per 100 pounds.

No. 134. *Lolium temulentum* Linn. Darnel.

An annual grass, 2 to 3 feet high, having a general resemblance to Italian Rye-grass, but usually stouter, more strictly erect, with longer glumes and larger seeds. It has been introduced into this country with the seeds of other grasses, and is occasionally met with in grain fields and about dwellings. The grain contains a narcotic or poisonous principle, which causes eruptions, trembling, and vertigo in man and flesh-eating animals. If the seeds are malted with barley, the ale causes intoxication very suddenly. It is contended by some that perfectly healthy Darnel seeds are innocuous—that only grains which are ergotized or otherwise diseased are injurious.

No. 135. *Manisuris*. Rat-tail-grass.

The native species of *Manisuris* are branching, leafy perennials, with slender, cylindrical, many-jointed spikes, which readily break up. They are found chiefly in the pine-barren swamps of the Gulf States. They are of little agricultural value in this country. *Manisuris compressa*, a native of southern Asia, south Africa,

and Australia, where it is called Mat-grass, has creeping or ascending flattened stems, rather short leaves, and slender spikes. In some parts of Australia it is highly esteemed for pasturage, and is said to retain its greenness throughout the year in dry climates. It is not injured by light frosts. The prostrate stems sometimes attain a length of 5 or 6 feet. A closely related species, *M. fasciculata*, occurs on the lower Rio Grande.

No. 136. *Melinis minutiflora* Beauv. Molasses-grass.

A sweet and highly nutritious species, and the most esteemed of the grasses of central Brazil, where it is native, growing upon the hills and dry lands. It is regarded a most excellent grass for dairy cows, and deserves a trial in the Southern and Southwestern States and California. The Brazilian names for this grass are "*Capim mellado*" and "*Capim gordura*." The English name given above is a translation of these. This species occurs also in Ascension Island, Natal, and Madagascar.

No. 137. *Muhlenbergia diffusa* Schreb. Nimble Will.
(Fig. 55.)

A low, slender, diffusely branched grass growing on dry hills, in woods, and especially in shady, waste grounds about dwellings. The leafy, wiry stems, which are from 6 to 18 inches long, spring from extensively creeping and rather tough rhizomes, which make a turf very difficult to break up. When young, this grass is readily eaten by all kinds of stock, but after it matures it is so tough that few animals will touch it. It possesses really very little agricultural value, and some look upon it rather as a weed. It is a native from southern New England to Iowa, Michigan, and southward, blooming in the latter part of summer.

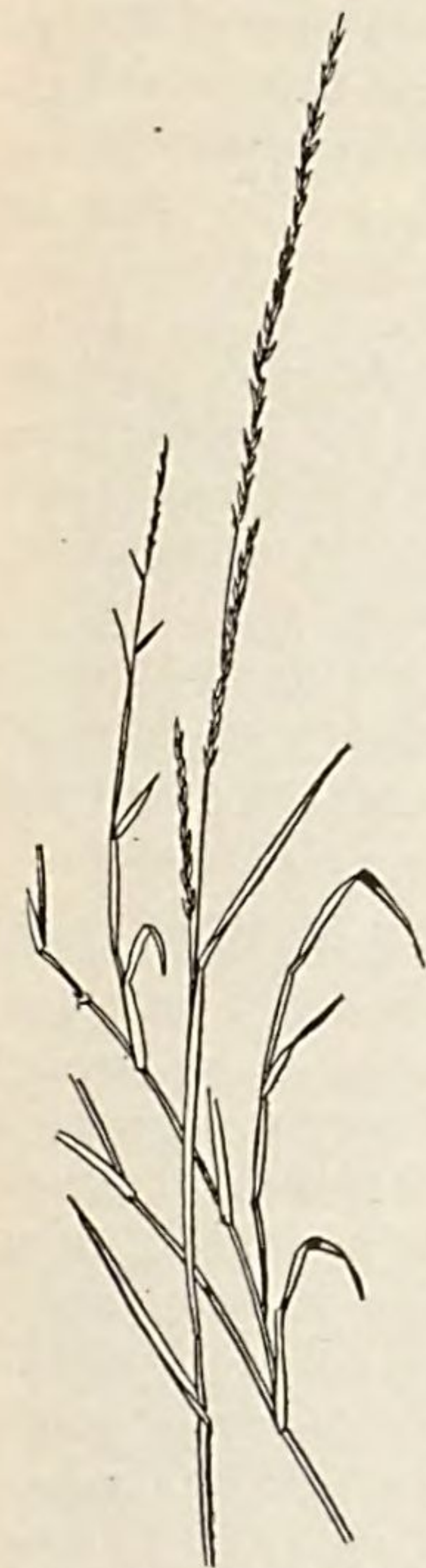


FIG. 55.—Nimble Will
(*Muhlenbergia diffusa*).

No. 138. *Muhlenbergia distichophylla* Kth. Bearded Saccaton.

This is a strong, firmly rooted grass, 3 to 4 feet high, with rather long and rigid leaves, and a narrow panicle often exceeding a foot in length. It is frequent in the rich valleys in Arizona and New Mexico, and on rich bottom lands it is often cut for hay. It is a coarse grass, like *Sporobolus wrightii*, and by the settlers is classed with it under the general name of Saccaton. In Arizona it forms the more common "hay" that one finds in the towns and way stations, being pulled by the Mexicans or Indians and brought in on the backs of donkeys or on carts. There are many species of *Muhlenbergia* in the southwestern part of the United States and northern Mexico, and doubtless many of them are of considerable agricultural value. *Muhlenbergia virescens* is a soft and leafy species growing in clumps on the higher slopes of the mountains in Arizona, and with *Poa fendleriana* forms the chief herbage of the so-called "deer parks" of the mountains. (Pringle.)



FIG. 56.—Knot-root grass
(*Muhlenbergia mexicana*).

No. 139. *Muhlenbergia mexicana* (Linn.) Trin. Knot-root grass. (Fig. 56.)

A much-branched, leafy perennial, 2 to 3 feet high, with strong, scaly, creeping rootstocks, which often do good service in binding river banks, along which this grass frequently grows. In the Northeastern States this grass is common in low meadows, where it occasionally forms a considerable proportion of the native hay of such places. If cut before the stems have become woody, which they do after flowering, the hay produced is of good quality. It ranges from New England southward to the Gulf and westward to the Rocky Mountains. In the Eastern States it blooms in August.

No. 140. *Muhlenbergia porteri* Scribn. Wire grama.

This grass is a native of New Mexico and Arizona, growing on the dry mesas and table-lands. It has a straggling habit of growth. The stems are 1 to 2 feet long, much branched, and often matted together. It furnishes excellent feed for cattle in the regions where it grows, and yields good hay, which is harvested in considerable abundance by the ranchmen. It withstands drought very well, but is soon run out under the continued trampling of cattle.



FIG. 57. — Wild Timothy
(*Muhlenbergia racemosa*.)

No. 141. *Muhlenbergia pungens* Thurb. Blow-out grass.

A rather rigid perennial, 12 to 18 inches high, with firm sharp-pointed leaves and open panicles. It has strong, creeping roots, and often does good service as a sand binder. In the sand-hills region of Nebraska it grows abundantly around the borders of the so-called "blow-outs," preventing their extension and assisting materially in restoring the turf. In some parts of Arizona where it occurs it is esteemed a valuable forage plant. It grows from Nebraska southward to New Mexico and Arizona, and along the Colorado River above Fort Yuma.

No. 142. *Muhlenbergia racemosa* (Michx.) B. S. P. Wild Timothy. (Fig. 57.)

An upright, usually sparingly branched perennial, 2 to 3 feet high, with densely flowered, narrow panicles 2 to 4 inches long, often resembling those of timothy. The rootstocks are very tough, and closely covered with thickened scales. It frequents bogs and low grounds from New England westward to the Rocky Mountains, extending southward to Tennessee, New Mexico, and

Texas. It is little prized in the East, but in the Northwestern States is recommended as an excellent grass for hay.

No. 143. *Opizia stolonifera* Presl. Mexican Lawn-grass.

An extensively creeping, dioecious grass, the very slender, prostrate stems sending up leafy tufts 1 to 4 inches high. Similar in habit to Bermuda, but more delicate. According to Dr. E. Palmer, this is one of the most important grasses of Mexico. Growing close to the ground, it forms a thick sod over all exposed surfaces, even over the cobblestones in the streets of towns. It is used in the public squares with good effect. By regular watering it is easily kept green, and but little cutting is necessary. The seed is difficult to obtain, owing to the constant nibbling of domestic animals. Propagation by cuttings of the rooting, prostrate stems is probably the best method. Trials with this grass ought to be undertaken in the Southern States, both for lawns and pastures.

No. 144. *Oplismenus setarius* R. & S. Creeping Beard-grass.

A slender perennial of the Gulf States, with decumbent or creeping stems, and short and rather broad leaves. It possesses no recognized agricultural value, but as it grows naturally under the dense shade of trees it might be used for covering the ground in shady places where other grasses will not thrive. It can be propagated by pieces of the stem, which root at the joints, and if cared for, will in a short time make a good turf. A closely allied grass of similar habit of growth, with variegated leaves, is often grown in greenhouses for its ornamental appearance.

No. 145. *Oryza sativa* Linn. Rice.

A tropical or subtropical, semiaquatic grass, the grain of which is the staple food of one-third of the human race. It is most extensively cultivated in southern Asia, China, and Japan. The annual produce of these countries is estimated at 100,000,000 tons. The rice-growing districts of China support the densest population in the world. In this country rice is cultivated in the States of South Carolina, Georgia, Louisiana, and Texas. The estimate of the crop of cleaned rice produced in Louisiana in 1895 was 82,436,832 pounds. "Paddy" is the grain in the husk. There are many varieties of rice, distinguished by color or size of the grain, absence or presence of beards, etc. There are two classes known as "lowland rice" and "upland rice." The latter is cultivated to some extent in western Tennessee. Rice straw is used for making paper.

No. 146. *Oryzopsis asperifolia* Michx. Mountain Rice.

A perennial, 6 to 18 inches high, with very long basal leaves overtopping the stems. This grows in rich, open woods, upon hillsides, from New England to Minnesota and northward. It is one of the early blooming species, flowering in May and ripening its seed in June and July. The leaves remain green throughout the winter.

No. 147. *Oryzopsis melanocarpa* Muhl. Black-fruited Mountain Rice.

A rather stout, long- and broad-leafed grass, 2 to 3 feet high, with a simple panicle of a few rather large spikelets. Grows in rich, rocky woods from New England southward to Pennsylvania and westward to the Rocky Mountains, blooming in July and August. These species of *Oryzopsis* have no recognized agricultural value, but they are very hardy perennials and might be propagated to advantage in woodland parks.

No. 148. *Oryzopsis micrantha* Thurb. Small Indian Millet.

A perennial, quite widely distributed throughout the central and western counties of the Dakotas and in eastern Montana. It grows in dry, sandy soil, and though tough and wiry, is nutritious and is considered a valuable grass.

No. 149. *Oryzopsis miliacea* (Linn.) Hack. Many-flowered Millet-grass.

A perennial, 2 to 3 or 4 feet high, with a many- and small-flowered nodding panicle, 6 to 12 inches long. It is a native of central and southern Europe, growing in dry, open woods and thickets. Was introduced into California in 1879, and has been cultivated experimentally with varying success at a number of points in that State. On the granitic soil of San Diego, California, it has grown 3 feet high without irrigation, and remained green throughout the year. Horses and cattle are said to eat it greedily. In Europe it is not regarded as possessing much, if any, agricultural value.

No. 150. *Panicularia americana* (Torr.) MacM. Reed Meadow-grass.

A stout, erect, leafy perennial, 3 to 4 feet high, with long, rather broad leaves, and a large, nodding panicle. It is common in the northern Middle States and southward along the mountains to Tennessee and North Carolina, extending westward to the Rocky Mountain region. It grows along streams and in moist meadows, and in such places often forms a considerable portion of the native hay. It is liked by cattle and is a good pasture grass for wet lands.

No. 151. *Panicularia canadensis* (Michx.) Kuntze. Rattlesnake-grass. (Fig. 58.)

A grass similar in habit to the last and growing in similar situations in the Northern States, extending southward to Pennsylvania and westward to Kansas. It is less common than *P. americana*. It has received no attention from the agriculturist. The nodding panicles of rather large spikelets are sometimes gathered for dry bouquets.

No. 152. *Panicularia fluitans* (Linn.) Kuntze. Floating Manna-grass. (Fig. 59.)

This grass grows to the height of from 3 to 5 feet, and has a narrow panicle composed of rather few long and narrow or cylindrical spikelets. It is a cosmopolitan species, found in all temperate regions of the world, and is regarded as one of the best fodder grasses for swampy meadows. In some parts of Europe the seeds are gathered and used for human food in the form of soups and gruels.



FIG. 58.—Rattlesnake-grass (*Panicularia canadensis*).

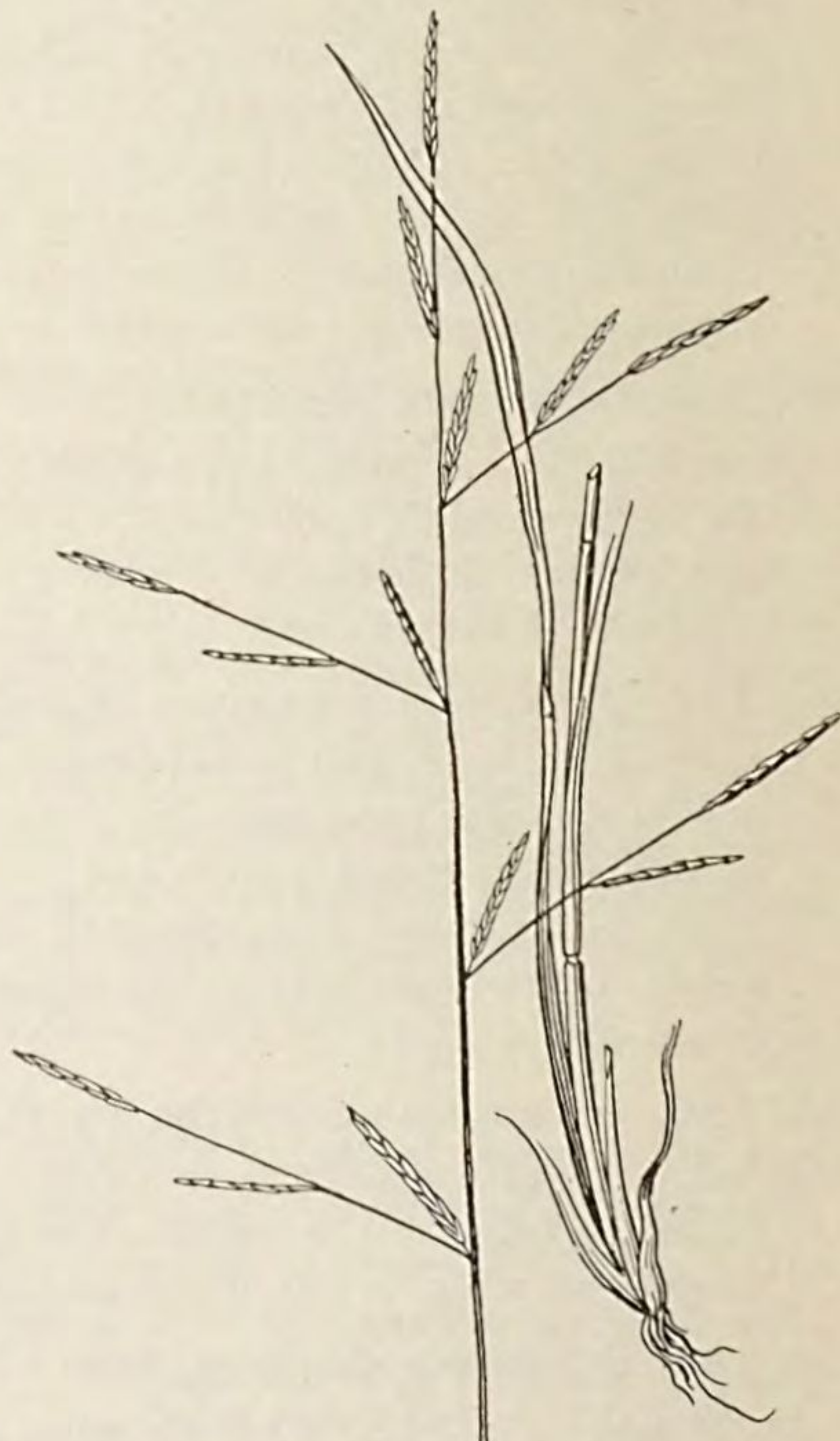


FIG. 59.—Floating Manna-grass (*Panicularia fluitans*).

No. 153. *Panicularia nervata* (Willd.) Kuntze. Fowl Meadow-grass. (Fig. 60.)

A leafy perennial, 1 to 3 feet high, with expanded nodding panicles of small spikelets. This is a common species in low meadows and moist grounds, extending from New England southward to the Gulf States and westward to the Pacific coast. It is a good fodder plant for moist meadows. Varies greatly in size, according to soil and location. *Panicularia americana* and *Panicularia nervata* furnish food for water fowl during the fall migrations and are valuable in game preserves along with *Zizania aquatica*.

No. 154. *Panicum agrostoides* Muhl. Munro-grass. (Fig. 61.)

A native perennial, with branching, leafy stems, 2 to 4 feet high, and a panicle resembling that of Redtop. It grows in low meadows and along the banks of creeks, shores of ponds, etc., and often yields a large amount of very good native

hay. In low, moist, and rather rich meadows its cultivation would doubtless be profitable, and it is certainly deserving of a trial in such locations.

No. 155. *Panicum amarum* Ell. Bitter Panic-grass. (Fig. 62.)

A grass of the sandy seacoasts, ranging from Connecticut southward to Florida and along the Gulf. It has coarse, hard stems, 1 to 5 feet high, and strong, creeping rootstocks, making it an excellent sand binder. The islands off the coast of Mississippi are almost wholly made up of drift sands, the outer sides being dunes from 10 to 30 feet high, while the middle of the islands is usually low and occupied by swamps or lakes. This bitter panic is very abundant upon the outside of these dunes, where it is exposed to the winds and waves, and where it serves to effectually bind the otherwise shifting sands. The leaves and stems have a bitter taste, hence the common name.



FIG. 60.—Fowl Meadow-grass (*Panicularia nervata*).



FIG. 61.—Munro-grass (*Panicum agrostoides*).



FIG. 62.—Bitter Panic-grass (*Panicum amarum*).

No. 156. *Panicum capillare* Linn. Old Witch-grass.

An annual, with usually coarse, branching stems, 1 to 3 feet long, hairy leaf sheaths, and widely spreading panicles. Grows in cultivated grounds, where it often becomes a somewhat troublesome weed. Being an annual, however, it is easily eradicated. Possesses no value for fodder excepting for fall feed on stubble.

No. 157. *Panicum ciliatissimum* Buckl. Indian Wheat.

A more or less extensively creeping perennial, with short leaves and upright flowering stems, 6 to 18 inches high. The panicles are narrow and few flowered, and in the prostrate forms usually partly included within the leaf sheaths. This grass is a native of western Texas, and doubtless possesses some agricultural value for the drier regions of the Southwest. The creeping stems resemble somewhat those of Bermuda-grass, but the leaves are usually more crowded and broader in proportion to their length.

No. 158. *Panicum colonum* Linn. Shama Millet.

A native of the tropical and warmer temperate regions of the Old World. In northern India it is considered one of the best fodder grasses. Introduced into the Southern and Southwestern States, where it is occasionally found in waste grounds about dwellings. It is closely related to *Panicum crus-galli*, differing from that grass in its smaller size and more simple inflorescence. The stems and leaves are tender and readily eaten by stock. In India the grain, which is produced abundantly, is sold in the markets and used for food.

No. 159. *Panicum crus-galli* Linn. Barnyard-grass. (Fig. 63.)

This well-known annual of rank growth is common in rich, cultivated ground, especially around dwellings. There are several forms presented by this species.

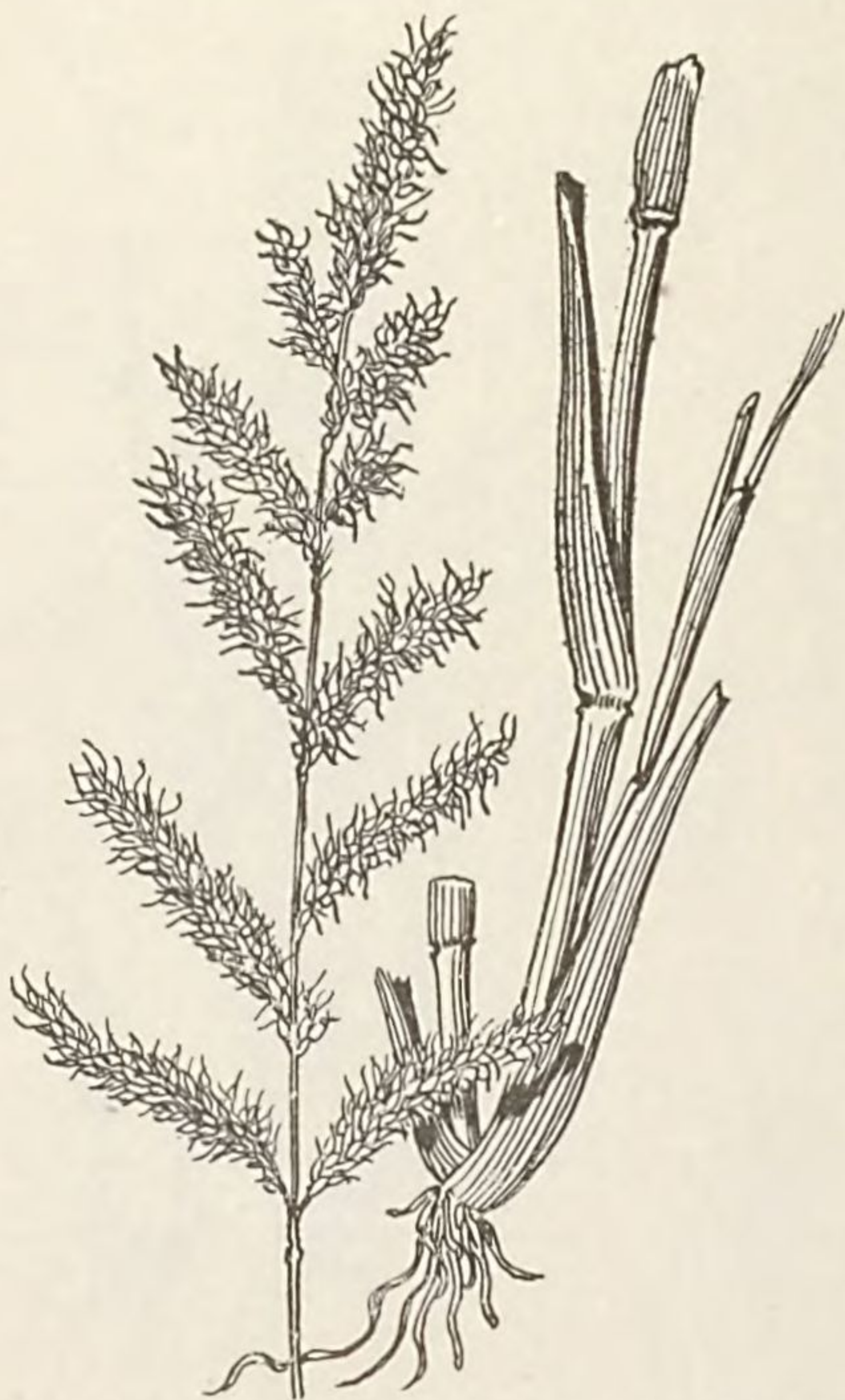


FIG. 63.—Barnyard-grass (*Panicum crus-galli*).

That growing as a weed around barnyards and dwellings, in cultivated grounds in the Atlantic States, was probably introduced from Europe. There are, however, several native varieties, or possibly good species. One of these occurring in the brackish marshes or meadows along the seacoast, grows to the height of 3 to 5 feet, with the lower leaf sheaths very hirsute, and the spikelets long-awned. A tall, smooth form occurs in New Mexico, Arizona, and the Mohave desert region, springing up after the summer rains in all swampy places or lowlands. It grows to the height of 6 or 7 feet, and its seeds, which it produces abundantly, are collected by the Mohave Indians, ground into flour, and cooked for food. The poorer classes of India also use the grain for food. A variety introduced from Japan has been cultivated at some of the experiment stations and treated as a millet. At the Hatch Experiment Station, in Massachusetts, the crop produced was very uniform, averaging 7 feet in height. The yield was at the rate of 11,207 pounds of straw per acre and 66.7 bushels of seed. When sown for silage or for soiling at the rate of one peck of seed to the acre, the yield

was at the rate of from 15 to 18 tons per acre. A field sown July 26, after a crop of hay was removed, yielded 12 tons per acre. It is very much liked by stock, and is a valuable forage plant for feeding green or for the silo. It is not so well adapted for hay, as it is a coarse, succulent grass, and rather difficult to dry.

No. 160. *Panicum digitarioides* Carpenter. Maiden Cane.

A rather coarse grass, 2 to 4 feet high, growing along ditches, in swamps, and in moist sands from Delaware southward to Florida and along the Gulf near the coast. It has strong and widely spreading or creeping rootstocks, which are useful in binding sandy railroad embankments in the Southern and Gulf States.

No. 161. *Panicum fasciculatum* Sw. Brown-top.

A rather coarse and much-branched leafy annual, growing in clumps to the height of 2 to 3 feet. The leaves are flat, one-fourth to one-half an inch wide, and 2 to 6 inches long. It is a native of Texas and Florida. Similar in character and closely allied botanically to *Panicum texanum*.

No. 162. *Panicum lachnanthum* Torr. Arizona Cotton-grass.

This is a native of the dry regions of Arizona and New Mexico. It resembles *Panicum lanatum*, but has more slender stems, which rise from strong, woolly, and knotted rootstocks. This may prove to be a valuable pasture grass for the dry or semiarid regions of the Southwest.

No. 163. *Panicum lanatum* Rottb. Cotton-grass.

A variable species widely distributed throughout the tropical regions of both hemispheres. It is a perennial with slender or stout stems 1 to 3 feet high, usually with flat leaves and narrow panicles, the spikelets being densely clothed with long silky or cottony hairs, which are white, or sometimes brownish or purplish. When abundant this grass yields excellent pasturage. It has been found in southern Florida and at other points near the Gulf coast. There is a variety of this species growing in the dry regions of Arizona and New Mexico which has more slender stems, that spring from strong woolly and knotted rhizomes. Doubtless this form would be a valuable pasture grass for the dry or semiarid regions where it is native.

No. 164. *Panicum maximum* Jacq. Guinea-grass. (Fig. 64.)

This grass was long ago introduced into America, presumably from tropical Africa, and has for many years been cultivated in tropical South America and the West Indies. In these regions it is spoken of as being a splendid pasture grass, growing to the height of 12 feet, forming dense tufts. It is readily propagated by cuttings of the creeping rootstocks. It has been introduced into some of the Gulf States, particularly Florida, where it is highly valued. Few grasses yield a larger amount of fodder, and it may be cut as often as once a month during the growing season. If allowed to attain its full size it becomes coarse and unfit for forage. Its stems are killed by the first frosts of autumn. It seeds only in the warmest parts of the States bordering the Gulf. It is much less hardy than Johnson-grass, with which it has been confounded by some, and has quite a distinct habit of growth.



FIG. 64.—Guinea-grass (*Panicum maximum*).

No. 165. *Panicum miliaceum* Linn. Broom-corn Millet.

A rather coarse annual, attaining a height of 2 to 4 feet, with large, drooping, loosely flowered panicles. There are several varieties, distinguished by the color of the fruit or character of the panicle. This is the true millet which has been cultivated in the East from prehistoric times, so that now its native country is not known. It is still cultivated to a considerable extent in China and Japan, also in South Russia and Roumania, and to a limited extent in other parts of Europe and North Africa. It requires a rich soil, and under favorable conditions its growth is very rapid and its production of seed large, in some instances amounting to 60 or 70 bushels to the acre. The grain is nutritious, and is one of the best for feeding poultry. When ground, the flour makes a

rich and nutritious porridge, for which purpose it is chiefly used in the eastern countries where the grass is grown. In northern India, where the grain is largely used, a preparation of it constitutes a favorite food at marriage ceremonies. Owing to its rapid and somewhat succulent growth, it is an excellent soiling plant. It has, however, been little cultivated in this country, but is occasionally found in the older settlements in cultivated fields and waste grounds about dwellings. The number of grasses termed millets in various parts of the world is large, and includes many very different species, whose grain, however, is used for human food. Most of the so-called millets belong to the genera *Chætochloa*, *Panicum*, and *Paspalum*. They form the principal food grains of the natives of many parts of Africa and Asia. It has been estimated that the millets feed one-third of the human race.

No. 166. *Panicum molle* Sw. Para-grass.

A rather coarse, reed-like perennial, 4 to 6 feet high, with hairy nodes, and narrow, lax panicles, 6 to 8 inches long. It is cultivated in South America, and in the West Indies and Mexico, and has been introduced into some of the Gulf States. It is grown with success on the high pine ridges of Florida, and wherever cultivated it is most highly esteemed and regarded as a very fattening pasture grass. How far to the north this grass may be grown successfully does not appear to have been determined, but it is hardy at the Cape of Good Hope and other far extra tropical regions (Baron von Mueller). It is propagated either by seeds or root cuttings.

No. 167. *Panicum obtusum* H. B. K. Vine Mesquit.

A stoloniferous grass, the runners attaining a length of 8 to 10 feet, the upright flowering culms 12 to 24 inches high. This grass ranges from Colorado to Texas, New Mexico, Arizona, and southward into Mexico. It is usually found in irrigated lands or in the low, damp soil of the valleys, most frequently under the shade of trees and shrubs. No attempts have been made to cultivate this grass, but its appearance and habit of growth indicate an agricultural value of sufficient importance to call for experiments in its cultivation. In New Mexico this species is called "Wire-grass."

No. 168. *Panicum plicatum* Lam. Palm-leafed Grass.

A broad-leafed perennial, 3 to 4 feet high or more, native of India. The leaves are elegantly striate and usually plicate, giving to the grass an unusual and at the same time attractive appearance. It is a favorite ornamental for greenhouse culture.

No. 169. *Panicum proliferum* Lam. Sprouting Crab-grass.

A smooth and usually much-branched native annual, with rather coarse, spreading or ascending stems 2 to 6 feet long, flat leaves, and diffuse terminal and lateral panicles. It grows naturally in moist, rich soil along the banks of streams and rivers, around the shores of ponds and lakes, and in the South is often abundant in rich, cultivated fields, growing with Crab-grass. The stout, succulent stems are sweetish and much liked by horses and cattle. Its range is from Maine to Nebraska, and southward to the Gulf, blossoming in the latter part of summer or early autumn. The spontaneous growth of this grass in cultivated fields after the removal of crops is of some value for hay or pasturage, but its cultivation can not be recommended in view of the fact that we have many annual grasses much superior to it. In the Northern and Middle States it is classed with the weeds.

No. 170. *Panicum repens* Linn. Creeping Panic.

An extensively creeping grass, with rather stiff upright stems, 1 to 2 feet high or less. It is common in the maritime districts in southern Asia, northern Africa,

southern Europe, and Australia. It is also found along the shores of the Southern States bordering the Gulf, extending westward to Mexico. It has no agricultural value, but is a natural sand binder. Upon the sandy islands lying off the Gulf Coast it grows abundantly upon the outside of dunes, protecting them from the action of the winds and waves.

No. 171. *Panicum sanguinale* Linn. Crab-grass.
(Fig. 65.)

A well-known annual, common in nearly all parts of the United States, growing in cultivated fields and about dwellings. It is a weed in gardens and among hoed crops. In grain fields after harvest it frequently springs up in such quantity, particularly in the Southern States, as to yield one or even two good cuttings of hay. This spontaneous growth affords excellent pasturage, as well as hay of first quality if properly cured. The stems are much branched, and in good soil attain a length of 3 to 4 feet. This grass contains little fiber, and dries quickly when cut, but if after cutting it is wet by rains or heavy dews its value for hay is almost wholly destroyed. In Bohemia, Crab-grass is

cultivated upon sandy soils and the grain is used for food in the form of mush or porridge.



FIG. 65.—Crab-grass (*Panicum sanguinale*).

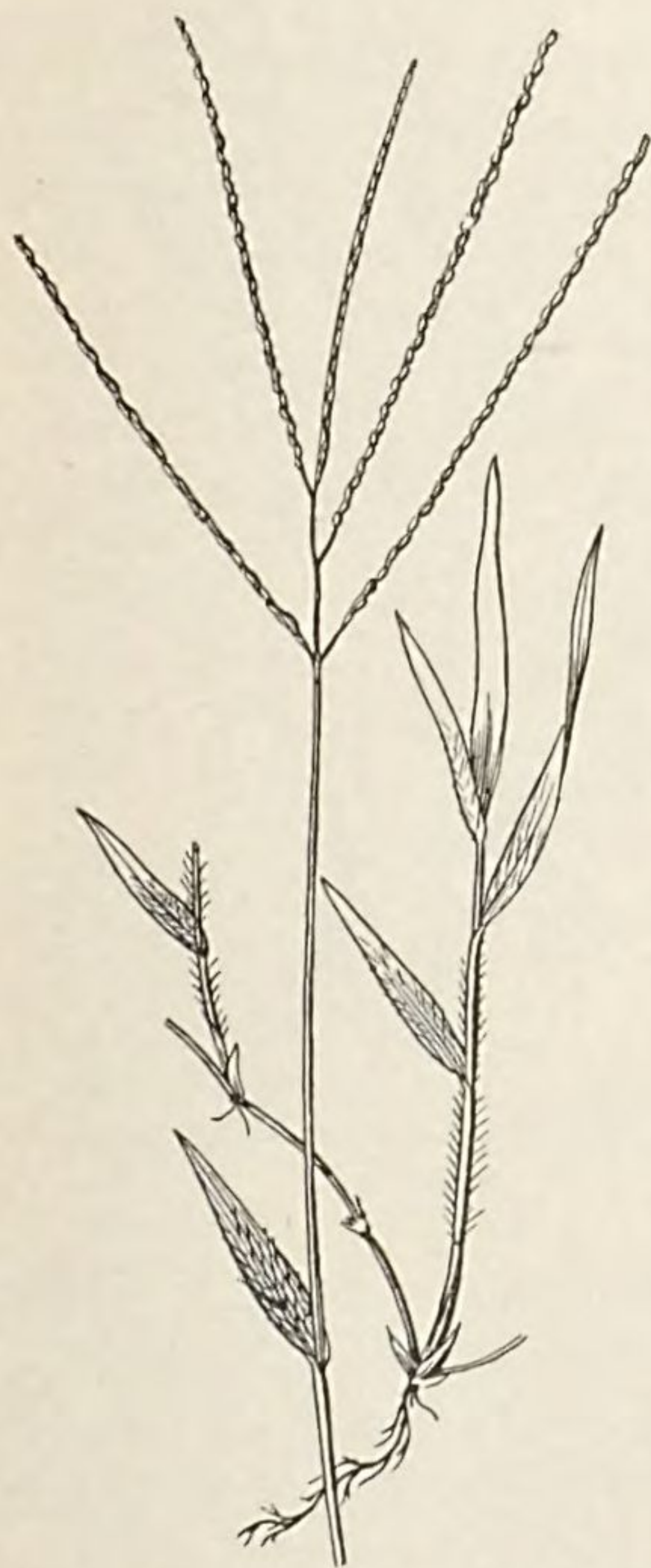


FIG. 66.—Creeping Crab-grass (*Panicum serotinum*).

No. 172. *Panicum serotinum* (Michx.) Trin. Little Crab-grass. (Fig. 66.)

A species related to Crab-grass (*Panicum sanguinale*), common in the Southern States near the Gulf, disputing with Louisiana-grass the claim of being the most valuable native pasture grass of that section. It is probably a biennial. It is much like Crab-grass, sending out leafy, creeping shoots at every joint, but is smaller in every way, with shorter and more hairy leaves of a lighter green color. It is invaluable for pasturage, forming a close turf, and driving out nearly all other plants. It grows best in sandy soil where there is a little moisture.

No. 173. *Panicum spectabile* Nees. Angola-grass.

A stout grass, 3 to 5 feet high, with rather broad and long (1 to 2 feet) leaves, and a terminal, densely flowered, compound and narrow spike 8 to 10 inches long. Imported into South America many years ago from the west coast of Africa (the region of Angola). It is cultivated on the low lands in the eastern part of Brazil, particularly in the region of Rio de Janeiro, where it is called

“Capim d’Angola.” This *Panicum* is closely related to and resembles some forms of Barnyard-grass (*P. crus-galli*). It is spoken of as an extremely productive and nutritious fodder-grass, and may prove valuable for the low regions along the Gulf coast.

No. 174. *Panicum sulcatum* Aubl. Palm-Leafed-grass.

A South American perennial, 4 to 6 feet high, with palm-like leaves 1 to 2 inches broad and 16 to 20 inches long, and long, terminal, narrow panicles which taper above and below. The leaves of this grass are deeply sulcate or plicate, like those of the Indian *P. plicatum*. Sometimes cultivated for ornament in green-houses or upon lawns.

No. 175. *Panicum texanum* Buckl. Colorado-grass. (Fig. 67.)

A branching, leafy annual, 2 to 4 feet high, with a narrow panicle 6 to 8 inches long terminating the main stem and branches. It is nutritious, of rapid growth, and upon good soil yields a large amount of excellent hay, and may be cut twice or even three times during the season. It reseeds itself readily. It prefers rich,



FIG. 67.—Colorado-grass (*Panicum texanum*).

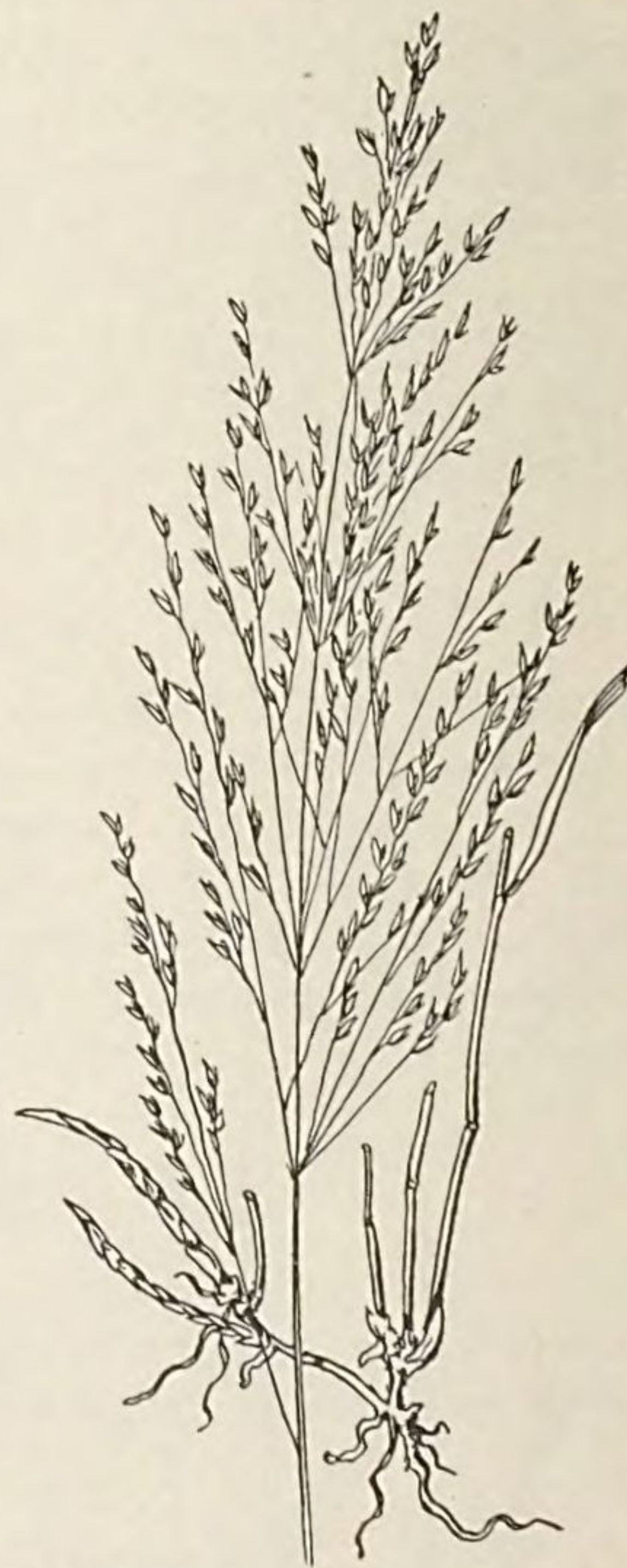


FIG. 68.—Switch-grass (*Panicum virgatum*).

alluvial soil along river bottoms, etc., and upon such land withstands drought well. In certain parts of Texas, particularly in the counties along the Colorado River, in the central part of the State, where it appears to be native and where it often comes up in cultivated fields after the removal of corn or other grain crops, it is spoken of in the highest terms as a hay-producing grass.

No. 176. *Panicum virgatum* Linn. Switch-grass. (Fig. 68.)

A tall, native perennial, 3 to 5 feet high, with strong, creeping rootstocks, long, flat leaves, and ample, spreading panicles. When young this affords good grazing, but at maturity the stems become hard and practically worthless for fodder. It ranges from Maine southward to the Gulf and westward to the Rocky Mountains. It is particularly common near the coast in sandy soil bordering the marshes, and oftentimes plays an important part there, in preventing the drifting of sands

by the winds or the washing of soils by overflows and high tides. On good lands it is very productive, and if cut before the stems have become hard yields a large amount of hay of very good quality.

No. 177. *Pappophorum laguroideum* Schrad.

A handsome ornamental, 3 to 5 feet high, with narrow, plume-like panicles a foot or more long. It is a native of Mexico, and has been successfully grown from seed on the grounds of the Department of Agriculture. It is worthy of introduction as an ornamental for gardens and lawns because of the beauty of its pale straw-colored panicles.

No. 178. *Pappophorum wrightii* S. Wats. Purple-grass.

A slender and apparently annual grass of western Texas, New Mexico, and Arizona, growing on the open plains and among the foothills of the mountains. It has short, narrow leaves and narrow, densely flowered heads or panicles, which are softly bearded and grayish or purplish. It is said to be fully equal to Grama or Buffalo-grass in nutritive value, and more palatable to horses or mules.

No. 179. *Paspalum boscianum* Flüge. Purple Paspalum.

A rather stout perennial with ascending branching stems, 2 to 3 feet high, long, flat leaves, and numerous racemes crowded near the summit of the culm and its branches. It is a native of the Southern States, growing in moist grounds, preferring rather heavy soils. Like other species of *Paspalum*, it grows in tufts and often occurs covering considerable areas to the exclusion of other grasses. It yields a good bulk of sweet hay, but is rather slow in drying.

No. 180. *Paspalum compressum* (Sw.) Nees.

A slender, erect, or more frequently prostrate and extensively creeping perennial, rooting at the nodes, and sending up numerous leafy, flower-bearing branches, 6 to 24 inches high. The very slender racemes or spikes borne at or near the summit of the stems are 1 to 3 inches long. The prostrate creeping stems spread rapidly, and soon form a dense, carpet-like growth, crowding out all other vegetation. It withstands protracted drought, grows well on almost any soil, and in the more southern districts is evergreen, yielding good pasturage both summer and winter. It is regarded as one of the most valuable native pasture grasses of the regions bordering the Gulf, and is a most excellent lawn grass, superior to Bermuda and less difficult to eradicate. It is found in the warmer regions of both North and South America. It is readily propagated by sets and seeds.



FIG. 69.—Carpet-grass (*Paspalum compressum*): *a*, attachment of spikelets to rachis; *b* and *c*, spikelets; *d*, floret.

No. 181. *Paspalum dilatatum* Poir. Large Water-grass.

A rather coarse leafy perennial, growing in clumps 2 to 5 feet high, bearing near the summit of the stems two to ten, more or less spreading racemes or spikes of crowded, hairy spikelets. It is a native of Brazil and possibly was originally introduced into the Southern States (where it has become quite widely distributed) from that country, although it may be a native here. It ranges northward from the Gulf to southern Virginia and Tennessee, and westward to Texas, growing most abundantly on low, black soils, which are well supplied with moisture. It is considered an excellent pasture grass, and when well established endures seasons of excessive drought without injury. It is particularly valuable as furnishing excellent late summer and autumn feed, during which period it makes its principal growth.



FIG. 70.—Knot-grass (*Paspalum distichum*).

No. 182. *Paspalum distichum* Linn. Knot-grass. (Fig. 70.)

A low creeping species, resembling Bermuda-grass. It is common in the Southern States along the seacoast and in the interior, extending southward from Virginia to the Gulf, and westward to Texas, Arizona, southern California, and northward to Oregon. It occurs throughout the tropical regions of both the Old and New Worlds. It grows in more or less sandy soils around the margins of ponds and along river banks. In such places it often does good service in binding soils subject to wash. The grass can well be recommended for this use.

Its stems are somewhat succulent, extensively creeping, rooting at the nodes. The leaves are tender, affording excellent grazing. The upright stems are a few inches to a foot high, and bear at their summits two slender spikes. This character at once serves to distinguish it from Bermuda, which has several spikes at the apex of the flowering culms.

No. 183. *Paspalum læve* Michx. Smooth Paspalum. (Fig. 71.)

A tufted native perennial, with ascending or erect stems, 1 to 3 feet long, flat leaves, and two to five, more or less spreading spikes, 2 to 4 inches long. Common in the Middle and Southern States, growing in open fields, meadows, etc., usually where the ground is somewhat moist. It is a late summer grass, blossoming from July to October. Well liked by all kinds of stock. In cultivated grounds, and particularly on lawns, which it occasionally invades, it must be classed as a weed.

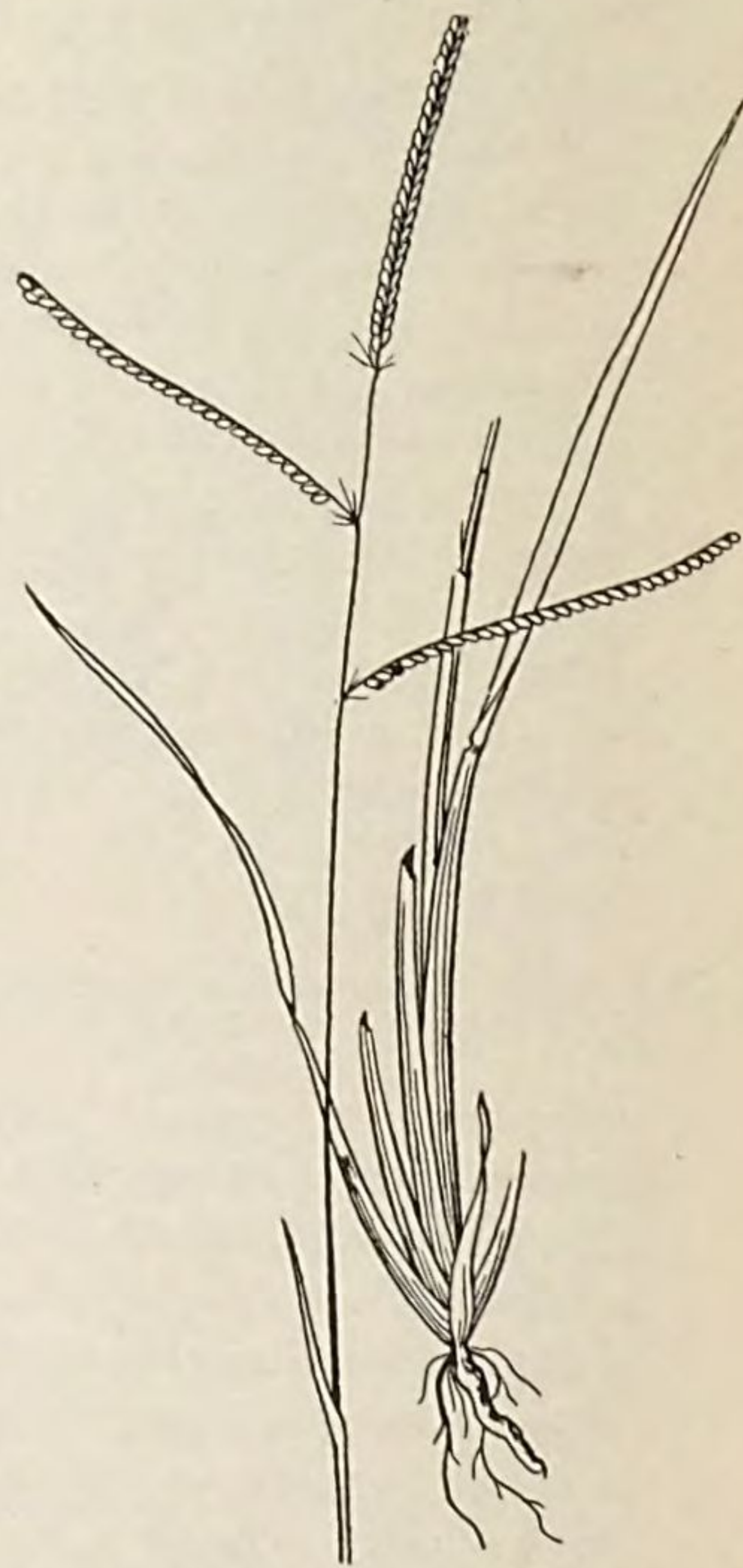


FIG. 71.—Smooth Paspalum (*Paspalum læve*).

No. 184. *Paspalum scrobiculatum* Linn. Ditch Millet.

A smooth annual, with branching, erect or ascending stems, 2 feet high or more. Widely distributed throughout the tropical and subtropical regions of both hemispheres. In northern India this grass is cultivated throughout the plains-region as a "rainy-season crop." It is usually sown on the poorer kinds of soil, the grain being chiefly consumed by the lower classes. The straw is used for fodder. (Duthie.) A variety of *P. scrobiculatum*, called "hureek" in India, which is perhaps the Ghohana-grass, an Indian species reputed poisonous, is said to render the milk of cows that graze upon it narcotic and drastic. (Lindley.)

No. 185. *Pennisetum japonicum* Trin.

Erect, with flattened simple stems, 1 to 2 feet high, very narrow leaves, and comparatively loosely flowered purplish or yellowish nodding panicles. A native of Japan. Occasionally cultivated as a curiosity or for ornament.

No. 186. *Pennisetum latifolium* Spreng.

A rather broad-leafed ornamental perennial, 3 to 5 feet high, branching above, with greenish rather dense panicles $1\frac{1}{2}$ to 2 inches long. Native of Uruguay and Argentina. In the latter country it is used for covering roofs of houses. Occasionally found cultivated here as an ornamental grass. It forms large tufts and is easily propagated by the roots or seeds. It may possess some value as a forage plant.

No. 187. *Pennisetum macrourum* Trin.

A South American species, with unbranched stems, 3 to 4 feet high, and densely flowered, cylindrical, yellowish panicles 6 to 8 inches long. Cultivated occasionally for its odd and ornamental appearance.

No. 188. *Pennisetum spicatum*. Pearl Millet.

An annual of luxuriant growth, 6 to 10 feet high, with long, broad leaves, stout culms, and terminal, erect, cylindrical, dense spikes 6 to 12 inches long, closely resembling those of the common cat-tail of the marshes. It is a native of the East, where it has been cultivated for its grain for many years. It is an important agricultural grass of Central Africa. It requires a rich loose soil to obtain the best growth, and under favorable conditions produces an enormous quantity of green fodder, for which purpose it can be cut several times during the season. It does not dry out readily and is often difficult to cure into hay. It has been cultivated with success as far North as Pennsylvania and in many parts of the South for a good many years. It is best sown in drills, about 2 feet apart, and 5 to 6 pounds of seed are required per acre. The weight of good seed per bushel is 56 pounds. The current price is \$12 to \$14 per 100 pounds.

No. 189. *Pennisetum villosum* Brown.

An Abyssinian species which has been introduced into cultivation because of its ornamental appearance. It grows to the height of 1 or 2 feet, has long narrow leaves, and dense, oblong or cylindrical, finely bearded heads 2 to 4 inches long. It is a hardy perennial, graceful and attractive in appearance, and is very frequently cultivated as an ornamental under the name of *Pennisetum longistylum*.

No. 190. *Phalaris arundinacea* Linn. Reed Canary-grass. (Pl. III, fig. 3.)

A tall, leafy perennial, 2 to 4 feet high, from a creeping rootstock, with smooth sheaths and narrow, branching panicles 4 to 8 inches long. It is a native, common on low, wet grounds, from New England southward to Tennessee, and extending across the continent to California and Washington. It is native also in Europe and northern Asia. It is little affected by either drought or cold, and thrives well in the shade. It succeeds best on stiff, wet land, and on wet, flooded fields and will grow fairly well upon rather dry, sandy soil. The rootstocks are very strong and creep extensively, making this grass particularly valuable for binding banks of rivers and ditches where the water supply is

ample. It does not attain its full size until the second year, and if designed for hay should be cut before flowering, for when fully mature the stems become woody and are too hard to make good fodder. The seed, which matures in July

and August, is easily gathered. Good seed should have 95 per cent purity and 60 per cent germination. It may be propagated by seed or by cuttings of the rootstocks, these being laid down at intervals of 1 foot, and slightly covered. The retail price of seed quoted in the New York market is \$35 per 100 pounds. A variety with white-striped leaves, called Ribbon-grass, is cultivated in gardens for ornament.



FIG. 72.—Canary-grass (*Phalaris canariensis*).

No. 191. *Phalaris canariensis* Linn. Canary-grass. (Fig. 72.)

An erect annual, 1 to 3 feet high, with flat leaves, and dense, ovoid panicles or heads about an inch long. This grass is apparently a native of the warmer countries of Europe, also of north Africa and western Asia. It has become widely distributed throughout the warmer temperate and tropical regions of the world, including Australia. Cultivated in Germany and southern Europe. It has been introduced into this country, and is occasionally cultivated for its seeds, which are used for bird food. The flour from the seeds is utilized in certain processes of cotton manufacture (weaver's glue), and is even employed in the making of some kinds of cake. It is frequently met with in waste grounds about dwellings in the vicinity of towns.

No. 192. *Phalaris caroliniana* Walt.

Southern Canary-grass; Apache Timothy.

This and *Phalaris angusta* (Fig. 73) have usually been regarded as one species, the latter as a variety with more elongated heads and rather stouter growth. Both the species and variety are perennials, ranging from South Carolina to Florida and westward to Texas, Arizona, California, and northward on the Pacific slope to Oregon. *Phalaris angusta*, a stout grass, 2 to 5 feet high, is sometimes called Apache Timothy, owing to the resemblance of its heads to those of timothy. In California it is not esteemed as of any agricultural value, but in the Southern States it has been cultivated to a limited extent, and is spoken of by some as being an excellent grass for winter and spring grazing, as it remains green throughout the winter season.

No. 193. *Phleum alpinum* Linn. Mountain Timothy.

This grass is a native of the mountain regions from Maine to California and northward; also in northern Europe and Asia. It is closely related to cultivated timothy. The stems are usually stouter, more leafy, but not so tall, under most favorable conditions attaining a height of 2 feet, but rarely exceeding a foot.

No. 194. *Phleum pratense* Linn. Timothy. (Fig. 74.)

This is one of the best known and most extensively cultivated hay grasses. It is a native of Europe (where it is known as cat's-tail), north Africa, and northern and middle Asia, and has become thoroughly naturalized in North America. It



FIG. 73.—Apache Timothy (*Phalaris angusta*).

appears to have been first cultivated in this country, and it was from this country that the seeds were obtained for its cultivation in England about the year 1760. It has never attained the same high esteem in England that it holds here, where it is regarded as the standard of comparison for all other grasses grown for hay. It succeeds best on moist loams or clays. In very dry ground the yield is apt to be light. On such soils the base of the stem is often thickened and bulb-like. Timothy is usually sown in mixtures with other grasses and clovers. It may be used with red or alsike clovers, or with redtop. Good fresh seed should have an average purity of 97 per cent and a germinative power of 85 to 90 per cent, a bushel weighing 48 pounds. The amount required per acre varies with the quality of the seed, but of that containing 87 per cent pure in germinating, 16 pounds to the acre is sufficient. It is better, however, to sow half a bushel to the acre if sown alone. With red or alsike clovers about 10 per cent timothy is a proper mixture.

No. 195. *Phragmites vulgaris* (Lam.) B. S. P. Common Reed.

This is one of the largest of our native grasses, growing to the height of 12 feet, the rather stout culms bearing numerous broad, spreading, and sharply pointed leaves 1 to 2 feet long. It has deeply penetrating and extensively creeping rootstocks, making it one of the most valuable grasses for binding the banks of rivers subject to periodical floods. It is occasionally found along the coast in brackish marshes and sometimes upon sandy soils, and possibly may be employed with advantage for binding drifting sands or those liable to be shifted by high tides. The rootstocks are very strong, and when the grass is once established scarcely anything can remove it. The young shoots are liked by cattle and the mature stems make the best of thatch. It is very widely distributed throughout the temperate regions of both hemispheres, growing along river banks, borders of lakes, etc.

No. 196. *Poa alsodes* A. Gray. Wood Spear-grass.

A slender, erect perennial, 1 to 3 feet high, with flat leaves and a narrow, rather few-flowered panicle. It is a native, growing upon the wooded hillsides of New England, extending westward to Wisconsin, and southward through New York, Pennsylvania, and Virginia, to the mountain regions of North Carolina and Tennessee. It possesses no recognized agricultural value, but is apparently a good fodder grass, and may possibly prove of value in cultivation in woodland parks. Other closely related species of *Poa* extend westward across the continent.

No. 197. *Poa annua* Linn. Low Spear-grass.

A low, spreading annual, with erect or ascending somewhat flattened stems, 2 to 12 inches high. This is an introduced grass, common in every dooryard and about dwellings and cultivated grounds. It may be found in bloom in the Southern States in almost every month in the year. It often forms a considerable ingredient in poorly kept lawns, as a result of its spontaneous growth.

No. 198. *Poa arachnifera* Torr. Texas Blue-grass.

A strong-growing perennial, 1 to 3 feet high, with extensively creeping rootstocks, long leaves, and narrow, densely flowered panicles. This grass is apparently dioecious. The pistillate or seed-bearing plants have the spikelets densely woolly, while the male spikelets are smooth. It is a native of Texas, but is now well known in most of the Southern States, where it has been introduced into culti-

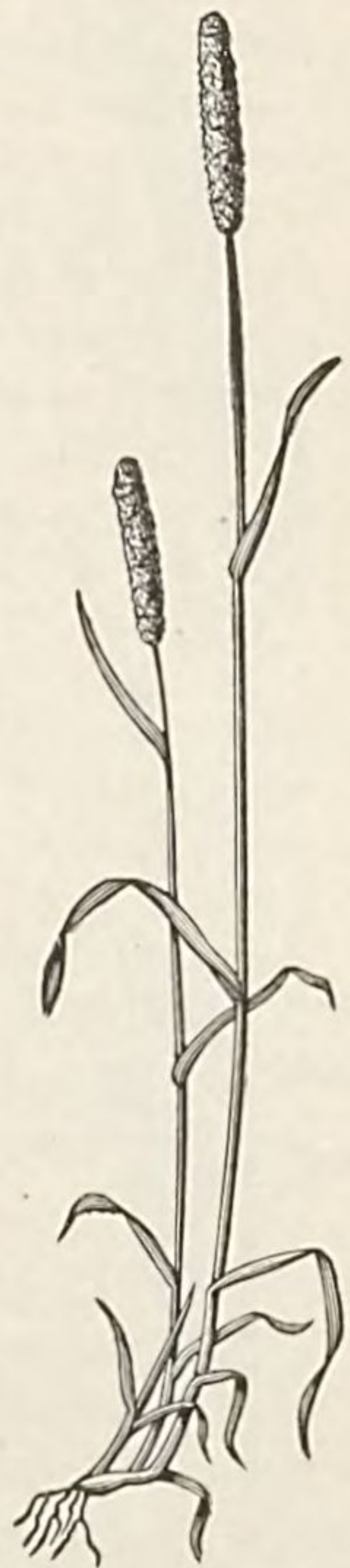


FIG. 74.—Timothy
(*Phleum pratense*).

vation, having been highly recommended as a permanent pasture grass. It may be propagated by seeds or "root cuttings," which can be obtained from leading seedsmen. It makes its principal growth during the winter months, coming into bloom in the latter part of April or early in May. It makes a good sod and withstands well the heat of summer and protracted drought. Owing to the wooliness of the seeds, they are difficult to sow, and as they are rather expensive this grass has not been so extensively propagated as it otherwise would have been. A somewhat troublesome, but more certain, method of propagation is by root cuttings. These may be planted at any time during the fall or early spring months, being set out in rows 2 feet apart and 6 to 10 inches apart in the rows. The retail price of the seed, according to New York catalogues, is \$3 per pound.

No. 199. *Poa arida* Vasey. Bunch Spear-grass.

A smooth, upright perennial, 1 to 2 feet high, with rather rigid, sharp-pointed leaves, and a close or narrow panicle 2 to 3 inches long. This grass is a native of the Rocky Mountain region, from the British Possessions southward to Arizona. It has short, creeping rootstocks, and although more rigid than many species of *Poa*, is one of the most valuable pasture grasses of the dry regions of the West.

No. 200. *Poa buckleyana* Nash. Bunch Red-top. (Fig. 75.)

Rather slender, 1 to 2 feet high, with no creeping rootstock, very narrow root leaves, and contracted panicles of usually purplish spikelets. It is a perennial, and a native of the Rocky Mountain regions, growing on the lower foothills and in the valleys. It grows in bunches, not forming a turf, and is regarded by the ranchmen as one of the most valuable "bunch grasses" of the cattle ranges. It has never been introduced into cultivation, but is deserving of attention, for it responds readily to improved conditions, and when growing along streams or in irrigated land makes a luxuriant growth of foliage, and often attains a height of 2 or 3 feet. There are many species of *Poa* native to the northern portion of our country, particularly in the Northwest, and all are tender, nutritious pasture grasses. Wherever grasses grow, from the seashore to the highest mountain tops, from one arctic zone to the other, the genus *Poa* has its representatives.

No. 201. *Poa compressa* Linn. Canadian Blue-grass.



FIG. 75.—Bunch Red-top (*Poa buckleyana*).

A slender perennial, with much-flattened stems, 6 to 20 inches high, and small, narrow panicles. This grass has extensively creeping rootstocks, and forms a strong turf. It is a native of Europe, which has become thoroughly naturalized, and is now very widely distributed over our territory. It is closely related to Kentucky Blue-grass, but it is more decidedly blue in color, and is readily distinguished from that species by its strongly flattened stems, lower habit of growth, and smaller panicle. It is the "Blue-grass" of the farmers of the New England and Middle States. It will grow upon a great variety of soils, even upon those so poor and thin as to exclude the growth of other grasses. In cultivated lands it is likely to become troublesome, owing to its creeping rootstocks. There is perhaps no better pasture grass for dry and poor soils, particularly in the Eastern and Middle States. It is especially valuable for dairy pastures; cows feeding on it yield the richest milk and finest butter. On good land it becomes sufficiently tall for hay, and as it shrinks very little in drying, the hay is heavy in proportion to its bulk. Seed is advertised by leading firms at \$14 per 100 pounds.

No. 202. *Poa fendleriana* (Steud.) Vasey. Mutton-grass.

Widely distributed in the Rocky Mountain region and on the Pacific Slope, extending southward through Arizona into Mexico. It grows in tufts to the height of 1 to 2 feet, has numerous long root-leaves, and short, compact heads or panicles. It is tender, and affords a large amount of excellent grazing in the regions where it grows abundantly, and may prove a valuable acquisition to the forage grasses of the Atlantic States.

No. 203. *Poa flabellata* Hook. Tussock-grass.

A native of the Falkland and adjacent islands, which has attracted the attention of travellers by its stout habit of growth and evident nutritious qualities. The flowering stems are 5 to 8 feet high, and these are often exceeded by the numerous radical leaves. This grass grows in great tussocks, 1 to 4 or 5 feet across. The stems and long leaves are used for thatch. "It loves a rank, wet, peat bog, with the sea spray dashing over it, and wherever the waves beat with greatest vehemence and the saline spray is carried farthest, there the tussock grass thrives the best, provided, also, it is on the soil it prefers." It thrives in cold countries near the sea in pure sand at the edge of peat bogs. The base of the stem is edible, having a taste of mountain cabbage, a species of palm. The introduction of this grass to certain points along our Northern seaboard, where other grasses will not thrive or where there is danger of encroachment upon the land by the sea, may be desirable. The nutritious qualities of the grass and its furnishing good fodder the year round upon the Falkland Islands has been repeatedly noted by authors.

No. 204. *Poa flava* Linn. False Red-top.

A native of northern Europe and the northern portions of our own country, growing naturally in wet meadows and along the low banks of streams. It attains the height of 2 to 3 feet, or even 4 feet in rich, moist soils, and has an expanded, nodding panicle of rather small, purplish, or "bronzed" spikelets. It is found in nearly all parts of New England, and often forms a very considerable and valued portion of the native hay of the low meadows. It has been cultivated to some extent, but should only be used in mixtures, as it does not make a good sod when sown alone. It blooms in July and August.

No. 205. *Poa nemoralis* Linn. Wood Meadow-grass.

The larger forms of this are hardly to be distinguished from *Poa flava*, and have a similar range. It will, however, grow in a drier soil, excessive moisture being harmful to it. In Montana this species ascends to the altitude of 9,000 feet. At this elevation it is dwarfed in habit, but at lower elevations it becomes taller and affords excellent forage. There are several varieties of this grass in the Rocky Mountains and the Northwest, some of them growing upon the dry foothills and bench lands. The larger forms are well adapted for hay. It is less productive than many others, and its cultivation is not recommended, excepting in shady parks or open woodlands where an increase of forage is desired, or in shaded lawns, and then only in the Northern and Middle States.

No. 206. *Poa nevadensis* Vasey. Nevada Blue-grass.

A perennial bunch grass from the western prairie and plains regions. It grows on both dry and damp soils, produces a large amount of excellent hay, and is apparently worthy of cultivation.

No. 207. *Poa pratensis* Linn. Kentucky Blue-grass. (Fig. 76.)

This is apparently native throughout the temperate regions of the northern hemisphere. It ranges from Labrador to South Carolina, westward to the Pacific coast and northward to Alaska. In the limestone regions of Kentucky and Tennessee it attains its greatest perfection and is there regarded as the king of

pasture grasses. It requires a good soil containing some lime in order to yield profitable crops. It is largely employed in the Eastern and Middle States as a lawn grass, for which use it is well adapted. It makes a good, firm sod, and is particularly well suited for turfing the slopes of terraces and embankments, where the soil is good. There are several varieties, which differ chiefly in the breadth and length of the leaves, particularly those at the base of the stem. It is not so well adapted for the production of hay as it is for pasturage. It should enter into all mixtures designed for permanent pasture. The slender stems of this grass afford an excellent material for the manufacture of the finer kinds of Leghorn hats. Good and well-cleaned seed should have 95 per cent purity and 50 per cent germinating power. The power of germination, however, is usually much below this figure. When used for lawns, sow at the rate

of 3 bushels per acre. According to Stebler and Schroeter, the seeds should never be covered, but only rolled after sowing, because they germinate better in the light than in darkness. This is the June-grass of the Northern States, Green-grass of Pennsylvania, and Smooth-stalked Meadow-grass of England.



FIG. 76.—Kentucky Blue-grass (*Poa pratensis*).

sandy soil. In northern Italy this grass is known as the “queen of forage plants,” but elsewhere, particularly in this country, it is not so highly esteemed, its principal use being to form bottom grass in permanent pastures. Seed of good quality should have 95 per cent purity and 50 per cent germination. When sown alone $1\frac{1}{2}$ to 2 bushels of seed are required per acre.

No. 210. *Poa wheeleri* Vasey. Wheeler’s Blue-grass.

A perennial native pasture grass that grows on the high plains and on the mountain slopes, below timber line, from Colorado northward. It is one of the best grazing grasses of the Rocky Mountains and promises to do well in cultivation.

No. 211. *Pollinia fulva* Benth. Sugar-grass.

A slender or rather stout perennial, 1 to 4 feet high, with narrow leaves and two to three terminal spikes, which are clothed with brown, silky hairs. It is a

No. 208. *Poa subaristata* Vasey. Vasey’s Spear-grass.

A perennial, from central Montana, where it is common on dry hills and mountain slopes, forming a large percentage of the grass and supplying good pasturage. It is an excellent species for cultivation in Northern pastures.

No. 209. *Poa trivialis* Linn. Rough-stalked Meadow-grass.

An erect perennial, 1 to 3 feet high, with an open, spreading panicle, closely related to Kentucky Blue-grass, from which it differs in having no conspicuous root-stock and the stem distinctly rough below the panicle. It has been cultivated for many years in England, and is now highly esteemed as an ingredient in mixtures for permanent pastures. It succeeds best where the climate and soil are rather moist and cool, but is not adapted to

native of Australia, found throughout all the colonies of that country, growing chiefly on the richest soils and on deep alluvial flats bordering rivers and creeks. It is productive, and much prized by cattlemen. The name "sugar-grass" is applied to this species on account of the sweetness of its stems and foliage. Mr. Fred Turner recommends it for cultivation on good land, especially in grazing districts, and he speaks of it as being a good grass to plant on the banks of rivers, creeks, and dams, as its strong, penetrating roots would help to bind the soil and prevent its being washed away by heavy rains or floods. This grass is classed as a variety of *Pollinia cummingii* Nees, by Hackel.

No. 212. *Puccinellia maritima* (Huds.) Parl. Sea Spear-grass.

A slender grass, 12 to 18 inches high, with creeping rhizomes. It occurs in the marshes along the seacoasts of New England and the Middle States, and forms a valuable element of the hay of tide-water marshes.

No. 213. *Redfieldia flexuosa* (Thurb.) Vasey. Redfield's-grass. (Fig. 77.)

A stout, native perennial, 18 inches to 4 feet high, with long, narrow leaves and diffusely spreading panicles, growing in the sandy districts of Nebraska, Colorado, and Kansas. It has deeply penetrating and widely spreading underground stems or rhizomes, making it a valuable species for binding drifting sands. It is a characteristic grass of the sand hills of central Nebraska, growing in the drifting sands and "blow-outs," and is a conspicuous and almost the only grass found on the sand dunes south of the Arkansas River, near Garden City, Kans.



FIG. 77.—Redfield's-grass (*Redfieldia flexuosa*).

No. 214. *Saccharum ciliare* Anderss.

A tall, handsome grass of India, with smooth stems, 8 to 10 feet high, long leaves, and large, showy panicles of silky-hairy flowers. Used in the manufacture of matting, rope, and paper, and for thatching. The stems are made into sieves, screens, and baskets. The thicker portion of the stems is used for lining wells, and in making chairs and couches. The leaves are sometimes used for fodder, and when young the grass is grazed by cattle.

No. 215. *Saccharum officinarum* L. Sugar Cane.

A stout grass with many-jointed stems, 8 to 15 feet high, broad leaves, 3 to 4 feet long, and long (16 to 32 inches), pyramidal panicles. Native country unknown, but sparingly spontaneous in the South Sea Islands, where it blossoms freely. Cultivated in all tropical countries. Propagated chiefly by cuttings of the stems. There are many varieties, distinguished chiefly by the color and height of stem. The leaves are sometimes used for fodder, and, to a limited extent, also in paper making. The cane is cultivated, however, for its sweet juice, which yields from 12 to 20 per cent sugar. Under favorable circumstances an acre of ground will produce about 20 tons of cane. In this country the production of cane sugar on a commercial scale is practically limited to the States of Loui-

siana and Texas. The sugar production in Louisiana in 1889 was 292,124,050 pounds. The world's production of cane sugar was then about 3,000,000 tons, more than one-third of which was produced by the West Indies. Molasses is a product of sugar cane (the uncrystallizable sugar), and rum is made from molasses. Refuse cane, from which the juice has been expressed, yields a strong fiber, and in parts of India is used for torches, etc.

No. 216. *Savastana odorata* (Linn.) Scribn. Vanilla-grass. (Fig. 78.)

A rather slender, sweet-scented perennial, 1 to 2 feet high, with short culm leaves and brownish panicles. Moist meadows and mountains of the Northeastern States, extending westward to Oregon. This grass, remarkable for its fragrance, has long, creeping rhizomes, from which spring the flowering culms and numerous

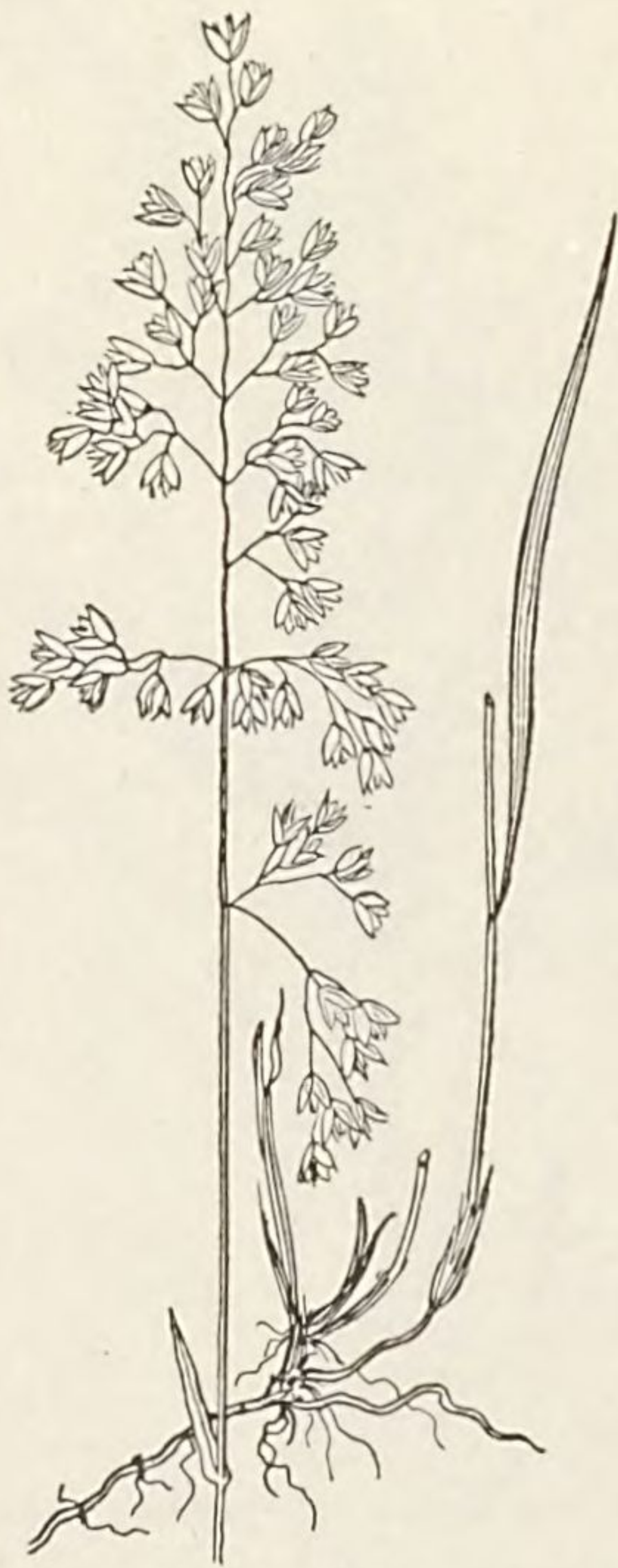


FIG. 78. — Vanilla-grass (*Savastana odorata*).



FIG. 79. — Cord-grass (*Spartina cynosuroides*).



FIG. 80. — Fox-grass (*Spartina patens*).

long-leaved sterile or flowerless shoots. These long leaves are woven into small mats and boxes by the Indians, and find a ready market because of the sweet odor, which they retain for a long time. This odor resembles that of sweet vernal grass, but is more powerful, especially when this grass is dry. In some European countries it is believed to have a tendency to induce sleep, and bunches of it are hung over beds for this purpose. It makes a good turf, but is of little value for forage. In the Northwest Vanilla-grass is generally called Sweet-grass.

No. 217. *Secale cereale* Linn. Rye.

An annual, 4 to 6 feet high, with flat leaves and a terminal, somewhat flattened, bearded spike 4 to 6 inches long. The rye crop of the United States in 1895 was 27,210,070 bushels, nearly half of which was produced in the States of

Pennsylvania, New York, and Wisconsin. Rye is more largely cultivated in central and northern Europe than in America; the grain is there very largely used for making bread. It is comparatively little used in this country for that purpose, being chiefly employed in the manufacture of malt and spirituous liquors. The straw, which is longer than that of other grains, and more uniform in size throughout, is employed in the making of a great variety of articles, such as paper, hats, bonnets, mats, slippers, toys, and fancy articles. Rye straw is little valued for fodder, but when green it is esteemed as a forage plant, and is sometimes sown for this purpose in the Southern States, cattle being allowed to graze on it during the fall and winter months. For winter grazing it should be sown upon well-prepared land early in August, when it will be ready to pasture or to cut green in the latter part of October, and may be grazed throughout the winter months.

No. 218. *Spartina cynosuroides* (Linn.) Willd. Cord-grass. (Fig. 79.)

Stout, with erect, simple stems 2 to 9 feet high, flat and long-pointed leaves, and numerous erect or spreading spikes 2 to 5 inches long. This is a native, common along our ocean and lake shores, borders of rivers, etc., ranging from Maine to the Carolinas, and westward to the Pacific. It makes a fair but rather coarse hay when cut early, and has been successfully employed in the manufacture of twine and paper. The strong, creeping, scaly rootstocks of this grass adapt it for binding loose sands and river banks, and in the West it is used for thatch.

No. 219. *Spartina patens* (Ait.) Muhl. Fox-grass. (Fig. 80.)

A rather slender species, 1 to 2 (rarely 3 to 4) feet high, with two to four slender, erect, or widely spreading spikes. This is common upon the salt marshes, and is one of the most valued species which go to form the salt hay that these marshes produce. It ranges from Maine southward to Florida and along the Gulf coast to Texas. It is useful for packing glassware, crockery, etc., and in the larger towns along the coast is much used for this purpose. Fox-grass and Black-grass (*Juncus gerardi*) are regarded as the best of the grasses of the salt marshes for the production of hay, and chemical analyses have proved the correctness of this opinion. Salt hay, composed chiefly of these grasses, at average market prices is decidedly cheaper than timothy hay.



FIG. 81.—Creek-sedge
(*Spartina stricta maritima*)

No. 220. *Spartina stricta maritima* (Walt.) Scribn. Creek-sedge. (Fig. 81.)

An erect and often stout salt marsh grass, with flat leaves, and few to many erect spikes. It varies a good deal in size, the larger form attaining a height of 5 to 8 feet. It grows along the ditches and creeks of the marshes, and is conspicuous by its size and long, shining leaves, which are of a deep green color. Smaller forms are found over the marshes away from the ditches, and these often are of a pale-green tint, with comparatively short and shining leaves. All the forms are somewhat succulent and have a rank odor, which is imparted to the milk and butter of cows feeding upon them. The species is of little value for fodder, but makes excellent thatch, and is used to some extent for litter and mulching. This is a characteristic grass of the salt marshes, and is found along both the Atlantic and Pacific coasts of our country and on the shores of Europe.

No. 221. *Spinifex hirsutus* Labill. Spiny Rolling-grass. (Fig. 82.)

A sand binder of the coasts of Australia, New Zealand, and Tasmania. It has stout,

creeping stems, rooting at the joints, and sending up coarse, leafy tufts. The whole plant is clothed with soft hairs. The male and female flowers are borne on separate plants, the latter in globular heads, which fall off at maturity and are driven over the sands by the winds, dropping their seeds as they roll along, or are carried about by the waves and deposited on newly formed sand bars, there to continue the embanking process. It has no value for forage, but in New South Wales is regarded a most useful grass for fixing drift sands when encroaching upon valuable lands. It is readily propagated by cuttings or joints

of the stems, is of comparatively quick growth, and is very persistent when once established. It would doubtless be of some value on our own Southern and Californian coasts as a sand binder.

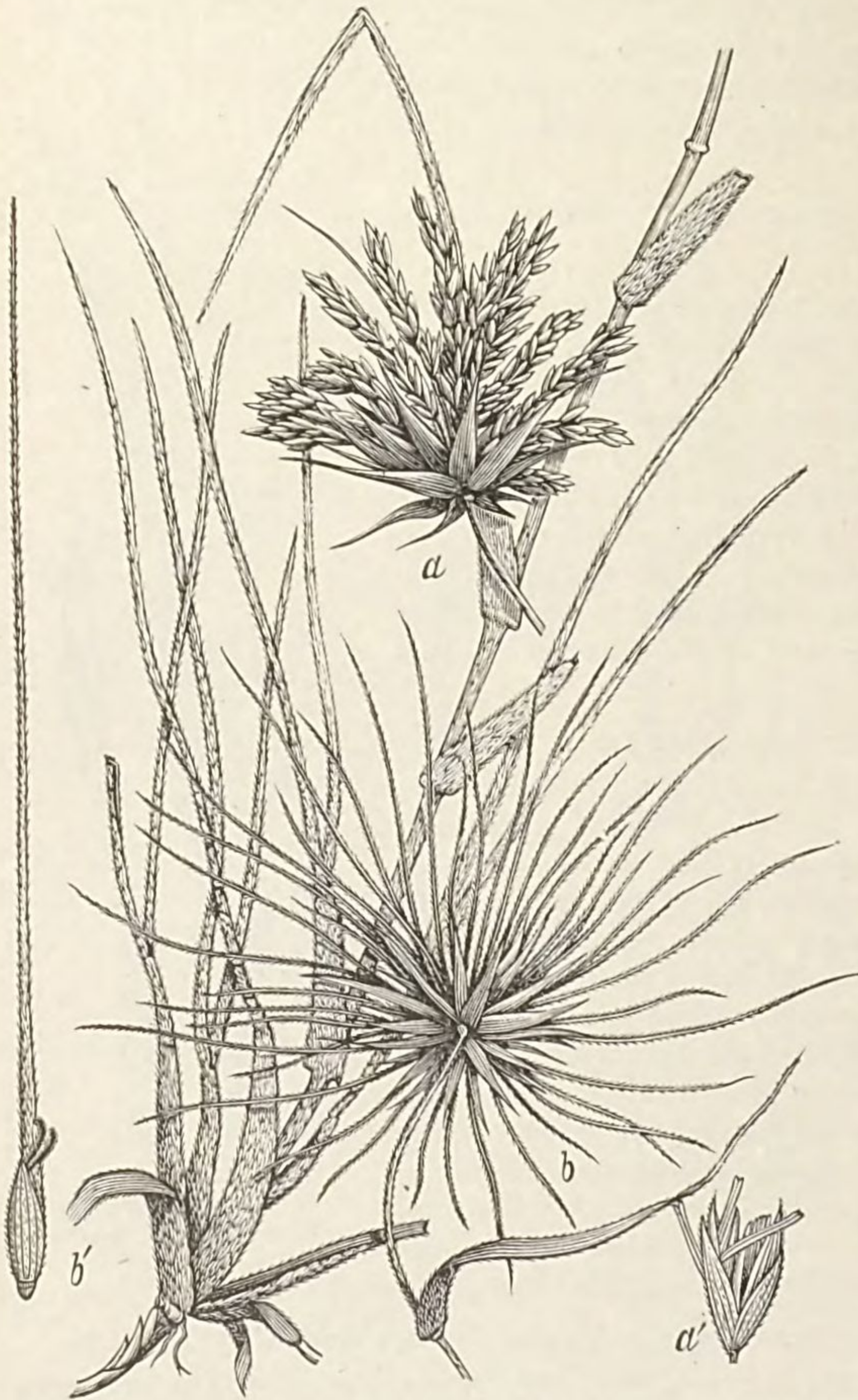


FIG. 82.—Spiny Rolling-grass (*Spinifex hirsutus*): *a*, male inflorescence; *b*, female inflorescence; *a'*, male spikelet; *b'*, female spikelet.

grass, 6 to 15 inches high, with numerous short, spreading, acute leaves, and an expanded capillary panicle 3 to 5 inches long. It grows on alkaline plains from Texas northwest to British Columbia, in similar situations as *Distichlis spicata*, and like that species often forms a dense, continuous turf. It grows well on strongly alkaline soil, and may prove valuable for propagation on such lands.

No. 224. *Sporobolus cryptandrus* (Torr.) A. Gray. Dropseed.

A strongly rooted perennial, 2 to 3 feet high, with usually narrow, rather densely flowered panicles, which are generally partially inclosed within the upper leaf-

No. 222. *Sporobolus airoides* Torr. Alkali Sacaton. (Fig. 83.)

A stout rather coarse and rigid grass, growing on tussocks in sandy and more or less alkaline or saline soils along rivers and streams, ranging from Montana southward to Texas and westward to California. It has a widely spreading panicle, more open than saccaton, and the grass rarely exceeds 2 feet in height. In some places in Nevada, Utah, and New Mexico it occurs abundantly, and yields a coarse fodder, which is eaten by stock when more tender grasses are not available.

No. 223. *Sporobolus asperifolius* (Nees and Mey.) Thurb. Fine-top Salt-grass.

A low, somewhat creeping

sheath. Common on the Western plains and in the Rocky Mountain region. It is a tender species, apparently well liked by stock, and where it occurs abundantly is very generally regarded as an important forage plant. In northern central Kansas it is spoken of as one of the best early grasses, and the same is said of it in Young County, Texas.

No. 225. *Sporobolus indicus* (Linn.) R. Br. Smut-grass. (Fig. 84.)

A tufted, wiry, erect perennial, 1 to 3 feet high, with narrow, densely flowered, spike-like panicles 4 to 12 inches long. This grass is widely distributed throughout the warmer temperate regions of the world, and has become quite common in many parts of the Southern States, growing in scattered tufts or patches about dwellings and in dry, open fields. As the season advances, the long, slender panicles often become overgrown by fungus, so that they appear as if

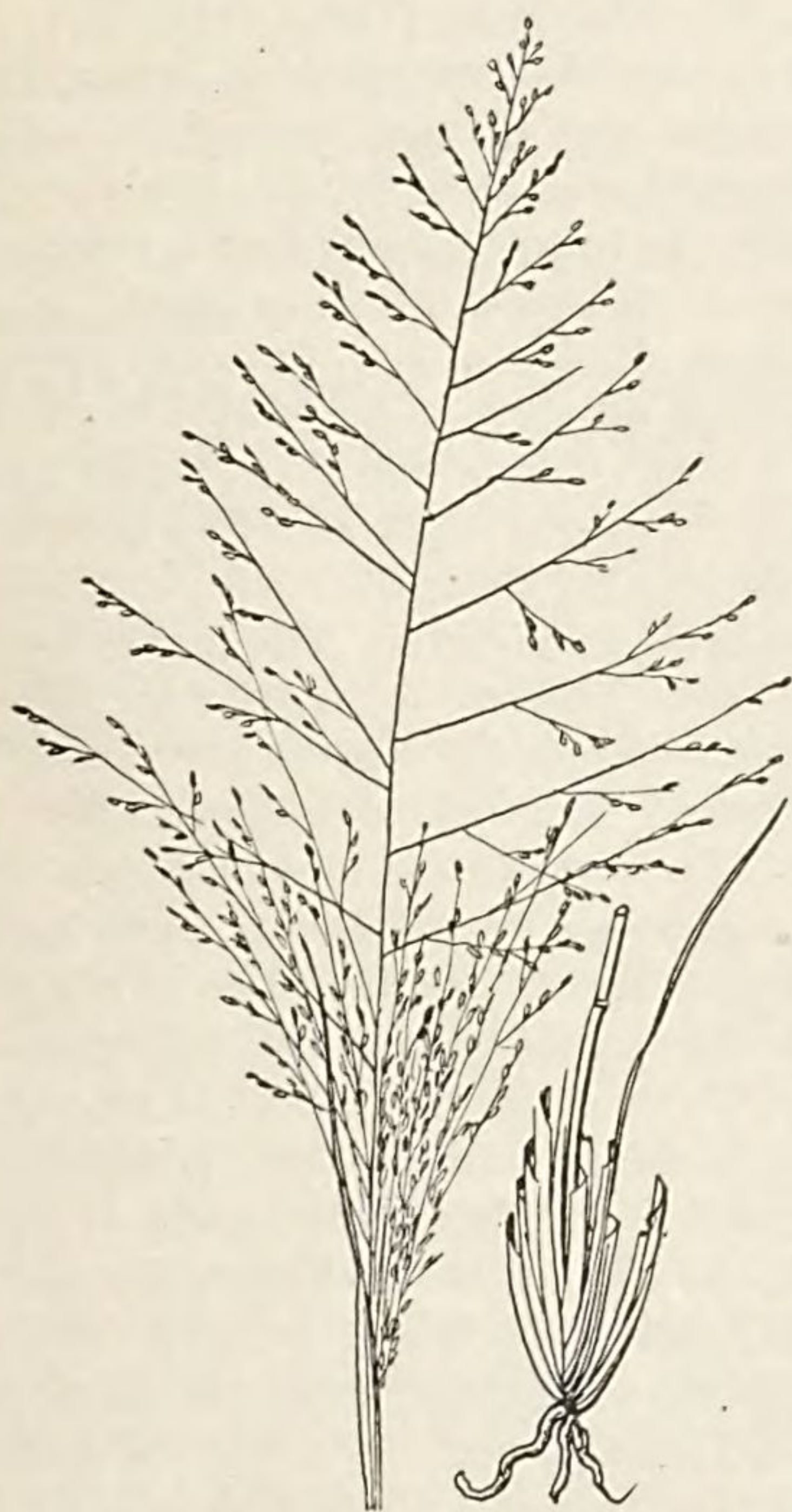


FIG. 83.—Alkali Saccaton (*Sporobolus airoides*).



FIG. 84.—Smut-grass (*Sporobolus indicus*).

attacked by smut; hence the common name "Smut-grass." By some it is looked upon as valuable for forage, but the stems soon become too tough and wiry to be readily eaten by stock, and in fields where this grass occurs it is usually avoided by cattle when other food can be had.

No. 226. *Sporobolus juncus* (Michx.) Kunth. Rush-grass.

Common in the dry, pine-barren regions of the Southeastern States. It grows to the height of 18 inches to 2 feet, and is of little or no agricultural value. This and *Aristida stricta* are known throughout the South as "Wire-grass."

No. 227. *Sporobolus orientalis* Kth. Usar-grass.

A wiry, creeping perennial, with rather short, rigid leaves and diffuse panicles. It is a native of India, growing upon saline soils, often constituting the entire vegetation of the extensive "usar" tracts of northern India. A valuable grass for

alkaline or saline soils, yielding a liberal supply of fodder where other plants are unable to exist.

No. 228. *Sporobolus wrightii* Munro. Saccaton. (Fig. 85.)

A stout, erect perennial, 4 to 8 feet high, with long, narrow leaves and a slightly spreading panicle 12 to 36 inches long. It grows in great clumps, producing a large quantity of coarse, tough stems and leaves, which, however, in the regions where this grass is native—Arizona and New Mexico—yield a hay which is valued for horses and mules. As a hardy perennial for saline bottoms subject to flooding or incapable of cultivation, this species deserves notice. The Indians and Mexicans of Arizona and Lower California call all hay grasses “zacate,” without any distinction between the species.



FIG. 85.—Saccaton (*Sporobolus wrightii*).

No. 229. *Stenotaphrum dimidiatum* (Linn.) Brongn. St. Augustine-grass. (Fig. 86.)

This grass has a wide distribution, being found in the tropical and warmer temperate regions of both the Old and New World. In New South Wales it is known as Buffalo-grass, and in Jamaica it is called Pimento-grass. It grows upon every variety of soil, from the apparently sterile sand dunes to heavy clays, but is rarely found far away from the coast. The flattened stems emit fibrous roots at every joint, where they also readily separate, each piece becoming a new center of growth. The leaves are flat or simply folded, blunt or obtuse at the apex, nearly one-fourth of an inch broad and 4 to 10 inches long. The flowering stems grow to the height of 6 inches to a foot or more. St. Augustine-grass grows along our ocean shores as far north as South Carolina, and is extensively used for lawns in Charleston, S. C., and cities in the South near the coast. It is useful for holding sloping embankments, especially those subject to wash. It is propagated by cuttings or sets, and quickly covers the most sandy yards with a dense, carpet-like growth. In South America the creeping stems are employed in medicine as a diuretic. This is the Buffalo-grass of Australia; and other local names in this country are Mission-grass and Charleston Lawn-grass.

No. 230. *Stipa comata* Trin. & Rupr. Needle-and-Thread.

This is one of the bunch grasses common in the Rocky Mountain region, growing on the dry mesas and foothills. It is a rather stout, leafy perennial, 1 to 3 feet high, with a panicle usually partly inclosed in the upper leaf sheath; the slender awns of the spikelets are 4 to 6 inches long and flexuose. This grass has some value, affording forage of good quality in the regions where it grows abundantly. In Dakota, Wyoming, etc., it is valued as a hay grass.

No. 231. *Stipa elegantissima* Labill.

A native of Australia, with erect, branching stems 2 to 3 feet high, narrow leaves, and loose panicles 6 to 8 inches long. The axis and long, thread-like branches of the panicle are elegantly plumose with fine, spreading hairs, rendering it highly ornamental. Cultivated in gardens.

No. 232. *Stipa leucotricha* Trin. & Rupr. Bearded Mesquite.

An erect perennial, 1 to 3 feet high, with very narrow leaves and a loose panicle with a few long-awned spikelets. One of the best native hay grasses of central and southern Texas.

No. 233. *Stipa pennata* Linn. Feather-grass.

A native of southern Europe, 1 to 2 feet high, growing in dry, open ground, and often cultivated in gardens as an ornamental, the very long, slender awns being clothed with spreading, silky hairs, presenting a very graceful plume-like appearance. A variety of this grass (*Stipa pennata neo-mexicana*) grows wild in the mountain regions of western Texas and Arizona. It is an elegant form of the species, growing in clumps 6 to 12 inches in diameter, and is deserving the attention of the florist.

No. 234. *Stipa setigera* Presl. Bear-grass.

A native of California, extending northward to Oregon and eastward through New Mexico and Arizona to Texas. It is common on the coast ranges and on the foothills of the Sierra Nevada, where it is regarded as one of the most valuable of the native bunch grasses.

No. 235. *Stipa spartea* Trin. Porcupine-grass.

Rather stout, 18 inches to 3 feet high, with long leaves and few-flowered panicles. The stout and twisted awns are 3 to 6 inches long, and at the base of the flowering glume is a long and very sharp-pointed callus. When mature, the awned flowering glumes soon fall off, leaving the large, pale, straw-colored, persistent empty glumes, which impart to the panicle a characteristic oat-like appearance. The awns, when dry, are bent and very strongly twisted, but when moistened they gradually untwist, a character which enables the seeds to bury themselves in the ground, this being possible on account of the very sharp callus at the base of the fruiting glume. The same character also renders the seeds of this grass dangerous to sheep, as they readily become attached to the wool, and may penetrate the flesh of the animal, causing serious injury. Aside from this danger of affecting the quality of the wool, and possibly the life of the sheep, this grass may be considered a good forage plant, as it makes a very good hay, although somewhat coarse. It is particularly common in the prairie regions of Iowa, Nebraska, South Dakota, and Minnesota, extending westward to the Rocky Mountains, where it frequently occurs upon the dry foothills and bench lands. This is the Buffalo-grass of the Saskatchewan region. In some localities it is known as Needle-grass, but that name is reserved for *Aristida fasciculata*. It is also known as "wild oats" in North Dakota.

No. 236. *Stipa tenacissima* Linn. Esparto.

A native of the sandy regions of southwestern Europe and northern Africa. It is a tall perennial, with long, stiff, and very tough leaves, from which ropes, baskets, mats, hats, and other articles are woven. The leaves are employed largely in England and this country in the manufacture of paper, for which purpose this grass is superior to straw. It is one of the most important articles of export from Algeria, and from northern Africa and Spain more than 2,000 tons of Esparto are exported to Great Britain annually. "Ten tons of dry Esparto, worth from \$18 to \$25 per ton, can be obtained from an acre under favorable circumstances."



FIG. 86.—St. Augustine-grass (*Stenotaphrum dimidiatum*).

The grass will grow on almost any kind of soil, from that which is poor and sandy or gravelly to heavy calcareous and clayey soils. It thrives in the dry and hot climates of northern Africa, where many millions of acres are covered almost exclusively with it. This grass is extensively cultivated in the south of France, and possibly its introduction into some of our Southwestern districts may render profitable, regions now practically worthless. It may be propagated by seeds or by divisions of the root. The latter is the more common method. This and *Lygeum spartum* constitute the Esparto of commerce.

No. 237. *Stipa vaseyi* Scribn. Sleepy-grass.

A stout bunch-grass 3 to 5 feet high, which grows in the Rocky Mountains at an altitude of from 5,000 to 6,000 feet. This grass, although producing a large bulk of stems and leaves, is regarded with suspicion by stockmen. It is said that

when this grass is eaten in a fresh state by horses it has a narcotic or poisonous effect, causing the animals to become crazed or "locoed," its action thus resembling that of the deadly loco weed (*Astragalus mollissimus*). Hay made from this grass does not apparently possess any poisonous qualities.



FIG. 87.—Feather Bunch-grass (*Stipa viridula*).

No. 238. *Stipa viridula* Trin. Feather Bunch-grass. (Fig. 87.)

A rather slender grass, 1 to 3 feet high, growing in the Rocky Mountain region and on the foothills and mesas, from British Columbia southward to Mexico and westward to the coast. On good land, under irrigation, this grass attains the height of 3 feet or more, and is by far the most valuable of the *Stipas* for hay. The leafy culms are terminated by a narrow, many-flowered panicle of comparatively small and rather short-awned spikelets. The seed may be easily gathered. The callus at the base of the fruiting glume is short and barely pointed and not produced into a long, very sharp, spur-like extension, as in Porcupine-grass.

No. 239. *Thuarea sarmentosa* Pers.

A low, extensively creeping grass, rooting at the joints, with ascending flowering branches, short leaves, and slender spikes about an inch

long. A native of Ceylon, northern Australia, etc., growing on the sands of the coast. It is a tender grass, and may be useful in binding coast sands in tropical countries or in the formation of lawns.

No. 240. *Trichloris blanchardiana* Scribn.

A perennial, $1\frac{1}{2}$ to 3 feet high, with flat leaves, and six to eighteen slender, bearded spikes, which are 2 to 5 inches long, digitate or fasciculate at the apex of the culm. It has long been known to florists under the name of *Chloropsis blanchardiana*, and is esteemed as an ornamental grass, its attractive appearance making it worthy of attention. It grows in Arizona and Mexico, extending into South America.

No. 241. *Tricholæna rosea* Nees.

A South African annual (?), with diffusely branching stems 2 to 4 feet high. The spikelets are in loose panicles, and clothed with reddish, silky hairs. It pre-

sents a pleasing appearance when in flower, and the panicles are valued for dry bouquets. It has recently received some attention by agriculturists on account of its very vigorous rapid growth and productiveness. Experiments made in this country and elsewhere indicate that it possesses much value as a meadow or hay grass in mild climates. Three hundred stems have been counted on a single plant. These stems take root wherever they touch the ground, and an acre has been calculated to yield 30 tons of green fodder in the rich valleys of the Macleay River, New South Wales. It is easily propagated by seed.

No. 242. *Triodia exigua* Kirk.

A little alpine grass, endemic in New Zealand. It forms even plots of turf, often many square yards in extent; the leaves are firm, short, and shining; the compact growth of the turf or sward prevents the encroachment of other grasses or weeds. It is particularly to be recommended for croquet lawns, never requiring mowing (Kirk). In the mountain regions of the West are several of these small turf-forming grasses, which would, if cultivated, make excellent carpet-like lawns in the region of the Northern and Middle States.

No. 243. *Triodia seslerioides* (Michx.) Benth. Fall Red-top.

A stout, erect, native perennial, 3 to 5 feet high, with long, flat leaves and an ample, spreading, usually purple panicle 6 to 12 inches long, growing in dry or sandy fields from southern New York southward and westward to Missouri, blooming in August and September. It is a striking grass, and often covers considerable areas, but is apparently not liked by stock, and is not recognized as possessing any agricultural value.

No. 244. *Tripsacum dactyloides* Linn. Gama-grass. (Fig. 88.)

A tall, coarse perennial, 3 to 8 feet high, growing in large tufts, and producing a great mass of broad leaves, which when young and succulent are eaten with avidity by all kinds of stock. When abundant it affords a large amount of natural forage, and is valuable to this extent. It has very strong, creeping rootstocks, and the quantity of forage produced is large and of excellent quality. The grass may be deserving of cultivation for forage under certain conditions, and it makes an interesting and attractive plant for lawn decoration or the garden. A rich and rather moist soil is best suited to it.



FIG. 88.—Gama-grass (*Tripsacum dactyloides*).

No. 245. *Trisetum pratense* Pers. Yellow Oat-grass.

A rather slender, loosely tufted perennial, growing to the height of 2 feet. It is a native of Europe, northern Africa, and western Asia. It occurs along roadsides, in open fields, and on grassy mountain slopes, where its presence is said to indicate land of good quality. In Europe, Yellow Oat-grass is classed with the best fodder plants and is highly valued for temporary, but more particularly for permanent pastures. It can be grown on almost every variety of soil, is fairly productive, and is readily eaten by stock. This grass has a record of yielding on clayey loam soils 8,167 pounds green grass, 2,858 of hay, and 4,083 of aftermath per acre. In this country it has received little attention. It is quoted in New York seed catalogues, the price ranging from \$70 to \$115 per 100 pounds. Sown only in mixtures.

No. 246. *Triticum æstivum* Linn. Wheat.

Wheat in its many varieties is one of the most important of the true grasses. It is one of the oldest of the cultivated cereals, the grains having been found in very ancient Egyptian monuments, dating back to 2,500 or 3,000 B. C. The numerous varieties are distinguished by the firmness of the axis of the spike (continuous), or its brittleness (articulated); by the presence or absence of awns or beard; by the color of the chaff, and color and size of the grain. *Triticum æstivum speltum*, of which there are a number of subvarieties, is one of the oldest grains, and was everywhere cultivated throughout the Roman Empire, forming the chief grain of Egypt and Greece. It is still grown to some extent in parts of Europe, notably in northern Spain and southern Germany. In 1895 the wheat crop of the United States was placed at 467,102,947 bushels, while the wheat crop of the world is

estimated at 2,400,000,000 bushels. For a discussion of the classification of the varieties of wheat, see Hackel's True Grasses (English translation), and the Fourth Annual Report of the New York Agricultural Experiment Station, 1885.



FIG. 89.—Broad-leaved Spike-grass (*Uniola latifolia*).

with the graceful, nodding, open panicles, render it pleasing in appearance and worthy of cultivation for ornament. It has very strong, creeping roots, and is found chiefly along streams and thicket borders from Pennsylvania southward and westward to Illinois. A grass of little or no agricultural value.

No. 249. *Uniola paniculata* Linn. Seaside Oats.

A native, with stout, erect stems 3 to 5 feet high, long, rigid leaves, and showy nodding panicles of broad, pale straw-colored spikelets. The panicles are gathered for dry bouquets, and are often seen in our markets, along with the plumes of Pampas-grass. It grows in the drifting sands along the seashore, just above high tide, from Virginia southward to Florida, and along the Gulf Coast westward to Texas. It is an excellent sand binder, its rootstocks being very strong and penetrating deeply into the soil, much like those of Beach or Marram grass,

No. 247. *Triticum polonicum* Linn. Wild-goose Wheat.

A very striking species or variety of wheat, with large, compressed, and usually bluish-green spikes or heads. The native country of this *Triticum* is not known, but it probably originated in Spain, where it is now cultivated to a considerable extent. It is also cultivated more or less in Italy and Abyssinia. The long and slender fruit resembles rye, but is on the whole larger. It has sometimes been advertised by seed dealers and sold to farmers under the name of Giant Rye. It is inferior to many other varieties, for, although the heads present a fine appearance, the production of kernels is small; consequently the yield of grain is light.

No. 248. *Uniola latifolia* Michx. Broad-leaved Spike-grass. (Fig. 89.)

Erect, with rather stout, leafy stems 2 to 4 feet high, and drooping panicles of large, flat spikelets. The leaves are broad and widely spreading, and these, together

of which it is a southern analogue. The leaves are sometimes cropped by cattle, but the grass is too tough and dry to be of any importance as a forage plant. *Uniola condensata* of similar habit of growth, but with more densely flowered panicles, is found in the sands along the coast of Lower California.

No. 250. *Zea mays* Linn. Indian Corn or Maize.

One of the most valued of the cultivated cereals. The many varieties which have originated in cultivation have been variously classified. They differ much in size, in the form, size, color, and hardness of the grain, and in the time required for ripening. Husk Maize, in which the kernels are separately enveloped in broad, herbaceous glumes, may approach the native form, which doubtless had its origin in tropical America. *Mais de coyote*, regarded by some as a distinct species, is said to grow wild in some parts of Mexico. The stems of this variety are branched above, and the numerous small ears are borne in the upper leaf axils all along the branches. The kernels are rounded and depressed, or conical with a rather acute apex pointing forward in two opposite rows, or irregularly arranged in four to six rows. Aside from its great value as a cereal, ordinary field corn is the best of the annual forage plants for soil-ing, and is also valued and used by many farmers for ensilage, being cut for this purpose when the kernels commence to glaze. Among the many uses of corn may be mentioned that of making cakes and corn bread, mush or hasty pudding, which is boiled corn meal, a very common dish in New England; mixed with rye and wheat flour the corn meal is used in making "brown bread"; green corn, boiled or roasted, is very largely eaten in its season, and canned corn is an important article of food; pickled green corn also is a favorite dish with many; hulled corn, or hominy, prepared by soaking the ripe grain in lye for a certain length of time and then removing the hulls or covering of the kernels, is a favorite dish in New England; popped corn, obtained by shaking the shelled corn of certain varieties in a suitable dish over live coals or a hot stove, is a luxury with children, and mixed with sugar or sirup is made into corn balls and various kinds of candy; corn and corn meal are largely fed to farm stock in this country, particularly to cattle and hogs; alcoholic liquors in immense quantities are distilled from the grain; corn husks (the leaves covering the ears) are used in making paper, in upholstery, and for filling mattresses. The total corn crop of the United States for the year 1895 was 2,151,138,580 bushels, valued at \$544,985,534. The largest crop of any one State for that year was produced by Iowa, and amounted to 298,502,650 bushels.



FIG. 90.—Wild Rice (*Zizania aquatica*).

No. 251. *Zizania aquatica* Linn. Wild Rice. (Fig. 90.)

A tall, erect annual, 3 to 10 feet high, growing in shallow water along rivers and lakes from Canada southward to Florida and westward to Texas. The grain is a favorite food of the reed bird, and the grass is cultivated to some extent by sportsmen with a view to attracting these and aquatic fowl. It grows very rapidly in 1 to 8 feet of water, and matures its seeds in August or early in September. It succeeds best when sown in the fall broadcast in 2 or 3 feet of water

having a muddy bottom, but it can be sown in the spring in water from 6 inches to 5 feet deep. Before sowing soak the seeds in water twenty-four hours. Current retail price of the seeds is 25 cents per pound. This grass is abundant in the tide waters of the rivers of the Middle States, notably in the Delaware below Philadelphia, where it is always designated as "the reeds." The stems are used by coopers for making the joints of barrels intended to hold whisky or

petroleum perfectly tight. This grass is the *Manorin* of the Chippewa Indians, who gather the grain for food.

No. 252. *Zoysia pungens* Willd. Japanese Lawn-grass. (Fig. 91.)

A creeping maritime grass growing on the sandy shores of tropical and eastern Asia, Australia, and New Zealand. In Australia it is considered an excellent sand-binder, and, while valuable for this purpose, it is at the same time an excellent forage plant. Under favorable circumstances it forms a compact turf and affords a large amount of choice pasturage. Constant cropping appears to improve it and increase the density of the turf. In the foreign settlements of China and Japan it is prized as a lawn grass, especially for tennis courts. It is

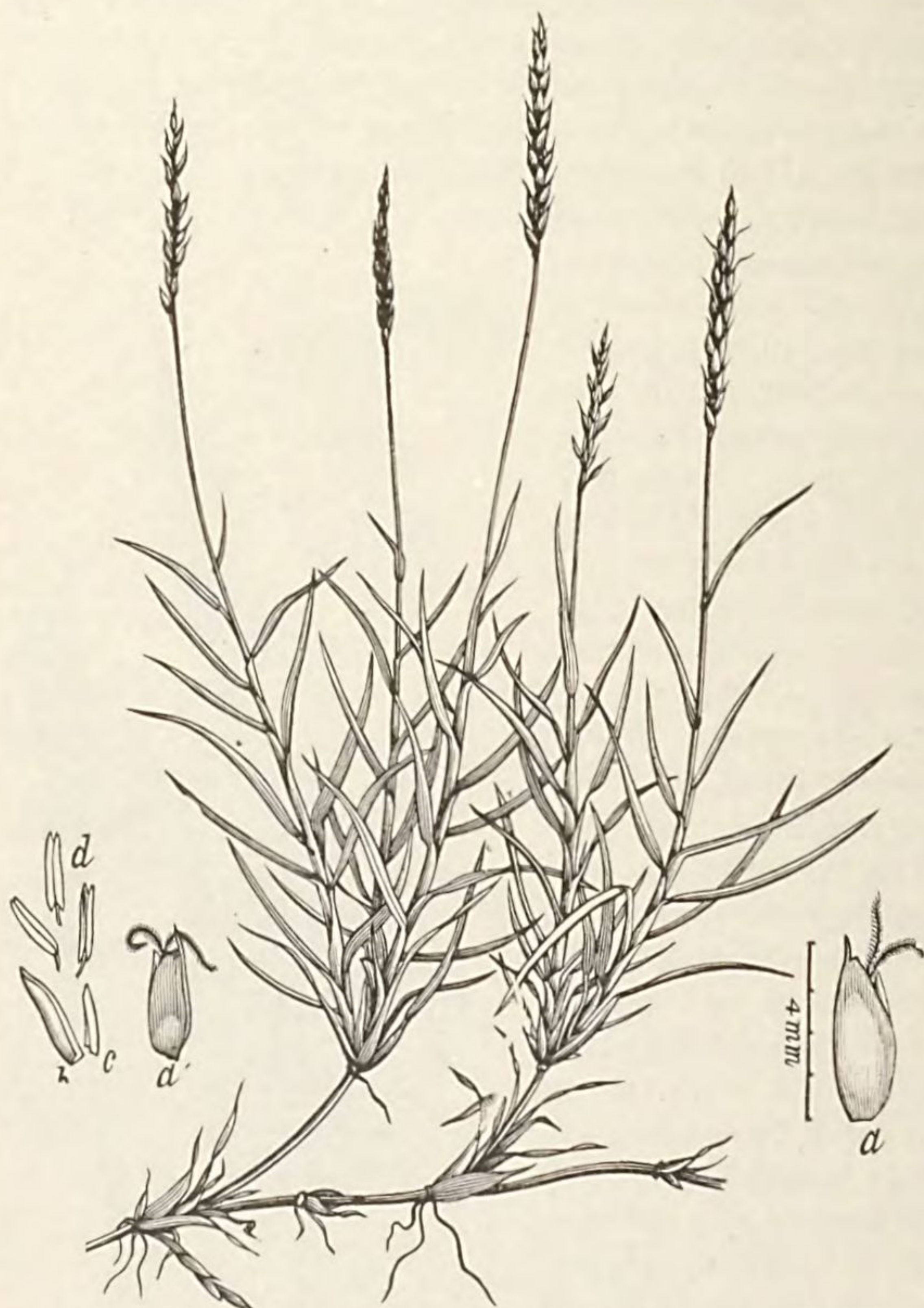


FIG. 91.—Japanese Lawn-grass (*Zoysia pungens*); a to d details of the spikelet.

finer-leaved than St. Augustine-grass, and may prove superior to that for lawns in the Southern and Gulf States. The habit of growth of Japanese lawn-grass is very similar to that of Bermuda, but the creeping stems are rather stouter and more rigid and the upright branches or tufts of flowering stems are never so tall, rarely exceeding 6 inches. It may be propagated by root cuttings or by seed. Importations of both roots and seeds from Korea have been successfully grown here, and the grass has proved hardy as far north as Connecticut. The leaves turn brown in the autumn, as do those of Bermuda.

GRASSES FOR SPECIAL SOILS OR USES.

The following lists include the best known and most valuable of the economic grasses. Descriptions of the species enumerated will be found in the body of the work. Seeds or roots of nearly all can be obtained from seedsmen.

HAY GRASSES.

Agropyron tenerum, *Agrostis alba*, *A. vulgaris*, *Alopecurus pratensis*, *Andropogon halepensis*, *A. provincialis*, *Arrhenatherum elatius*, *Astrebla pectinata*, *Avena sativa*, *Bouteloua curtipendula*, *Brachypodium japonicum*, *Bromus inermis*, *Chaetochloa italica*, *Cynodon dactylon*, *Cynosurus cristatus*, *Dactylis glomerata*, *Eragrostis abyssinica*, *Euchlœna luxurians*, *Festuca elatior*, *Hordeum sativum*, *Lolium italicum*, *L. perenne*, *Oryza sativa*, *Panicum crus-galli*, *P. maximum*, *P. miliaceum*, *P. molle*, *P. sanguinale*, *P. texanum*, *Pennisetum spicatum*, *Phalaris arundinacea*, *Phleum pratense*, *Poa pratensis*, *Saccharum officinarum*, *Tricholœna rosea*, *Trisetum pratense*, *Triticum æstivum*, *Zea mays*.

PASTURE GRASSES.

Agropyron divergens, *Agrostis alba*, *A. stolonifera*, *A. vulgaris*, *Andropogon nutans*, *A. provincialis*, *A. scoparius*, *Aristida fasciculata*, *Astrebla pectinata*, *Bouteloua curtipendula*, *B. eriopoda*, *B. oligostachya*, *Brachypodium japonicum*, *Bromus unioloides*, *B. inermis*, *Bulbilis dactyloides*, *Chloris verticillata*, *Cynodon dactylon*, *Dactylis glomerata*, *Eriochloa punctata*, *Eriocoma cuspidata*, *Festuca duriuscula*, *F. elatior*, *F. ovina*, *F. rubra*, *Hilaria cenchroides*, *Lolium perenne*, *Panicum ciliatissimum*, *Paspalum compressum*, *P. distichum*, *Poa arachnifera*, *P. compressa*, *P. pratensis*, *P. trivialis*, *Secale cereale*, *Stenotaphrum dimidiatum*.

LAWN GRASSES.

Agrostis coarctata, *A. stolonifera*, *A. canina*, *Bulbilis dactyloides*, *Cynodon dactylon*, *Festuca heterophylla*, *F. rubra*, *Fourniera mexicana*, *Opizia stolonifera*, *Paspalum compressum*, *Poa nemoralis*, *P. pratensis*, *P. trivialis*, *Stenotaphrum dimidiatum*, *Zoysia pungens*. (See paper on "Lawns and Lawn Making" in Yearbook of the Department for 1897.)

GRASSES FOR WET LANDS.

Agrostis alba, *A. coarctata*, *A. vulgaris*, *A. stolonifera*, *Arundinaria macrosperma*, *A. tecta*, *Calamagrostis canadensis*, *Chaetochloa magna*, *Distichlis spicata*, *Festuca rubra*, *Holcus lanatus*, *Lolium italicum*, *Oryza sativa*, *Panicularia americana*, *P. fluitans*, *P. nervata*, *Panicum crus-galli*, *P. molle*, *Paspalum compressum*, *P. distichum*, *Phalaris arundinacea*, *Poa flava*, *P. pratensis*, *Stenotaphrum dimidiatum*, *Zizania aquatica*.

GRASSES FOR EMBANKMENTS.

Agropyron repens, *Andropogon halepensis*, *A. squarrosus*, *Arundinaria macrosperma*, *Bromus inermis*, *Calamovilfa longifolia*, *Cynodon dactylon*, *Distichlis spicata*, *Festuca rubra*, *Imperata arundinacea*, *Panicum digitarioides*, *P. obtusum*, *P. repens*, *Paspalum compressum*, *P. distichum*, *Phalaris arundinacea*, *Phragmites vulgaris*, *Spartina cynosuroides*, *Stenotaphrum dimidiatum*, *Zoysia pungens*.

GRASSES FOR HOLDING SHIFTING SANDS.

Agrostis coarctata, *Ammophila arenaria*, *Andropogon hallii*, *Calamovilfa longifolia*, *Cynodon dactylon*, *Elymus arenarius*, *E. mollis*, *Eragrostis obtusiflora*, *Imperata arundinacea*, *Muhlenbergia pungens*, *Panicum amarum*, *P. repens*, *Redfieldia flexuosa*, *Spartina patens*, *Spinifex hirsutus*, *Stenotaphrum dimidiatum*, *Thuarea sarmentosa*, *Uniola paniculata*, *Poa macrantha*, *Zoysia pungens*. (See paper on "Grasses as Sand and Soil Binders" in the Year-book of the Department for 1894.)

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